Engineering Library

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The Engineer

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PUBLIC NOTICES

Civil Service Commission.

FORTHCOMING EXAMINATION :—ASSISTANT EXAMINERS in the Patent Office (20-25, with extension in certain cases).

Regulations and particulars are obtainable from the SECRETARY, Civil Service Commission, Burlington-gardens, London, W. 1, together with the form on which application must be made. The latest date for the receipt of application forms is 12th July. 8561

For Sale.

At NASSAU, N.P., BAHAMAS, B.W.I., ONE 8 Cubic Yard Steel British Harbour Type DREDGER, built in 1923 by Lobnitz and Co., Renfrew, Scotland, and registered at Lloyds as a 100 A1 Class sea-going dredger.

Dimensions of hull, 110ft. by 44ft. by 12ft.
Maximum dredging depth, 35ft.

The Dredger has recently completed important dredging operations in connection with harbour improvements for the Government of the Bahamas. The Dredger has recently been dry-docked and thoroughly overhauled and passed by Lloyds' Surveyors prior to selling. She is a sound, reliable, and economic machine, admirably suited for digging channels or deepening harbours.

For further particulars apply to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, London, S.W. 1 (quoting "W/Bahamas 875"), or the COLONIAL SECRETARY, Nassau, N.P., Bahamas. 8632

The Director-General,

India Store Department, Belvedere-road, Lambeth, S.E. 1, invites TENDERS for :—

SCHEDULE 1.—LOCOMOTIVE BOILERS, LOCOMOTIVE CYLINDERS and other DETAILS.

SCHEDULE 2.—BRIDGE WORK, Eight Spans of 258ft.

Tenders due on the 26th June, 1928, for No. 1, and on the 24th July, 1928, for No. 2.

Forms of Tender obtainable from the above at a fee (which will not be returned) of 5s. for each Schedule. 8644

Maintenance Engineer

REQUIRED by the GOVERNMENT of the GOLD COAST for WATERWORKS, for two tours of 12 to 18 months' service. Salary £480 a year for three years and then £510, rising to £920 a year by annual increments. Outfit allowance of £60 on first appointment; free quarters and passages; liberal leave on full salary. Candidates, aged 25 to 35, must be Students or Associate Members of the Institution of Civil Engineers, have been trained in the office of a Waterworks Engineer and/or have been employed in the construction and maintenance of Waterworks, and be competent to design and supervise the construction of Reinforced Concrete Storage Tanks.—Apply at once by letter, stating age, qualifications and experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, London, S.W. 1, quoting M/716. 8647

Armourers and Brasiers' Company.

LECTURES IN METALLURGY.

The Company have arranged for the following Lectures to be delivered :—

At the ROYAL SCHOOL of MINES, Prince Consort-road, South Kensington, at 5.15 p.m. on 4th, 11th, and 18th June, 1928, by
GEORGE MORTIMER, Esq.,
on
"THE FOUNDING OF ALUMINIUM AND ITS LIGHT ALLOYS."

At the BATTERSEA POLYTECHNIC, Battersea Park-road, S.W., at 7 p.m. on 5th, 12th, and 19th June, 1928, by
Dr. J. M. ROBERTSON, B.Sc., Ph.D., A.R.T.C.,
on
"THE HEAT TREATMENT OF STEEL."
Admission free, without ticket. 8585

Armstrong College,

NEWCASTLE-UPON-TYNE.

(IN THE UNIVERSITY OF DURHAM.)

COURSES for the PASS DEGREE of B.Sc. and the HONOURS DEGREE of B.SC. in MECHANICAL, MARINE, CIVIL or ELECTRICAL ENGINEERING, MINING, METALLURGY, or NAVAL ARCHITECTURE. The curricula of the Pass Degree and the Honours Degree normally occupy periods of three and four years respectively, but candidates presenting evidence of sufficient previous training may be allowed to proceed to either Degree after two years' residence.

The engineering laboratories have recently been extended, and all Departments are equipped for advanced tutorial and research work.

Full particulars of the Courses may be had on application to

THE REGISTRAR,
Armstrong College,
7059 Newcastle-upon-Tyne.

Borough Polytechnic Institute,

BOROUGH-ROAD, LONDON, S.E. 1.

APPOINTMENT OF ENGINEERING WORKSHOP INSTRUCTOR.

The GOVERNORS REQUIRE in September next a full-time ENGINEERING WORKSHOP INSTRUCTOR for Day School and Evening Work. Candidates should be highly skilled craftsmen, under 40 years of age, and have had sound works training and experience in modern tool-room methods and processes. Minimum salary £290 per annum.

Further particulars as to salary and conditions of appointment on application to the Principal.

8544 J. W. BISPHAM, Principal.

Administrative County of London.

ROBERT BLAIR FELLOWSHIPS IN APPLIED SCIENCE AND TECHNOLOGY.

The London County Council invites APPLICATIONS for the AWARD of TWO ROBERT BLAIR FELLOWSHIPS in APPLIED SCIENCE and TECHNOLOGY, each of the value of £450, tenable for one year. The Fellowships are for advanced study or research in applied science and technology, and will be tenable in the Dominions, the United States or other foreign countries.

Candidates must be British subjects and at least twenty-one years of age.

Further particulars and application forms (T.2.a./300) may be obtained from the Education Officer (T.2.a.), The County Hall, S.E. 1 (stamped addressed envelope necessary), to whom the form must be returned by 18th June, 1928.

MONTAGU H. COX,
8215 Clerk of the London County Council.

The Institution of Structural Engineers.

REPORT ON MATERIALS AND WORKMANSHIP FOR REINFORCED CONCRETE.

The publication of the above Report, which was drawn up by the Science Concrete Sectional Committee, has been approved by the Council of the Institution. The main headings of the contents include :—Materials and Workmanship; Cement; Fine Aggregate; Coarse Aggregate; Proportions; Water; Mixing; Tests for Compression Strength of Concrete; Reinforcement, Mild Steel, Hard-drawn Steel Wire; Formwork; Concreting; Fittings and Accessories; Tests on Completed Work.

Copies of the Report, price 1s. 8d. per copy post free, may be obtained from the undersigned.

MAURICE G. KIDDY, F.I.S.A.,
Secretary.
10, Upper Belgrave-street, S.W. 1,
17th May, 1928. 8553

City of Chichester.

CITY ENGINEER'S DEPARTMENT.

TENDERS are INVITED for the SUPPLY of 500 LINEAL YARDS (or more) of 3in. SPIGOTED and SOCKETED CAST IRON PIPES coated with Dr. Angus Smith's Solution.

Tenders to be sent to the undersigned, stating earliest date of delivery.

FRANK J. LOBLEY, A.M. Inst. C.E.,
City Engineer.
"Greyfriars," Chichester,
30th May, 1928. 8641

PUBLIC NOTICES

Edmonton Union.

PROVISION OF FIRE ESCAPE STAIRS.

The Guardians invite TENDERS for the SUPPLY and FIXING of IRON FIRE ESCAPE STAIRS at Edgebury House, Woburn Sands, near Bletchley.

Tender forms, upon which only Tenders will be received, obtainable on application to me, accompanied by a stamped addressed foolscap envelope.

Sealed Tenders, endorsed "Tender for Fire Escape Stairs," to be sent to me by not later than 9 a.m. on Friday, the 8th June, 1928.

By Order,
E. RIDLEY,
Clerk to the Guardians.
Board Room,
77, Bridport-road, Edmonton, N. 18. 8618

Metropolitan Borough of St. Marylebone.

DEMOLITION AND RECONSTRUCTION OF CANAL BRIDGE, PARK-ROAD, ST. MARYLEBONE.

The Council of the Metropolitan Borough of St. Marylebone are prepared to receive TENDERS for the DEMOLITION and RECONSTRUCTION in STEEL and CONCRETE of the CANAL BRIDGE, PARK-ROAD.

The existing bridge is to be demolished and replaced by a steel and concrete bridge, of one skew span 45ft. clear. The day fixed for the completion of the work is May the 21st, 1929.

Drawings and specification, &c., may be seen on and after Friday, 1st June, 1928, at the offices of
The Borough Engineer, Town Hall, St. Marylebone; or of
Sir E. Owen Williams, K.B.E., 5, St. George's-road, Westminster, London, S.W. 1.

The contract documents, including bill of quantities and drawings, may be obtained on and after the same date at the office of the Engineer, Sir E. Owen Williams, K.B.E., 5, St. George's-road, Westminster, S.W. 1, on the payment of a deposit of £5 5s. and the receipt of an undertaking to return all such documents and drawings. Cheques must be made payable to the St. Marylebone Borough Council. The deposit will be returned in due course to contractors who have submitted bona fide Tenders.

Sealed Tenders, endorsed "Tender, Canal Bridge, Park-road," must be lodged with the undersigned not later than Twelve Noon on Thursday, 14th June, 1928. The Council do not bind themselves to accept the lowest or any Tender.

Dated this 22nd day of May, 1928.
REGINALD C. GRAVES,
Town Clerk.
Town Clerk's Office,
Town Hall, St. Marylebone, N.W. 1. 8619

PUBLIC NOTICES

PATENTS AND DESIGNS ACTS, 1907 TO 1928.

Notice is Hereby Given that AKTIESELSKAPET AMUNDSEN REFRIGERATOR CO., of Kongensgatan 6, Oslo, Norway, a Company incorporated under the laws of Norway, SEEK LEAVE to AMEND the SPECIFICATION of LETTERS PATENT No. 266,683 granted to Ivar Amundsen for an invention entitled "Method for the Production of Cold."

Particulars of the proposed Amendment were set forth in the Illustrated Official Journal (Patents) of the 23rd May, 1928.

Any person, or persons, may give Notice of Opposition to the Amendment by leaving Patents Form 19 at the Patent Office, 25, Southampton-buildings, London, W.C. 2, within one calendar month from the date of the said Journal.

W. S. JARRATT,
P4577 Comptroller-General.

Aberdeen Waterworks.

SALE OF OLD MACHINERY.

The Aberdeen Town Council are prepared to receive TENDERS for the following MACHINERY at their Pumping Stations at Cults, near Aberdeen, viz.:—

One Compound Steam Engine (built 1885), I.H.P. about 100, driving force pumps;
One Compound Tandem Steam Engine (built 1885), I.H.P. about 70, driving force pumps;
One Greenwood and Batley Steam Turbine, I.H.P. about 30, driving Rees centrifugal pump (built 1917);
Two Lancashire Steam Boilers, insured at 80 lb. (built 1885);
Two Hydraulic Pumping Engines (built 1866).

Conditions of sale and brief description of plant may be obtained on application, on and after Wednesday, 30th May, 1928.

Sealed Tenders, endorsed "Old Machinery," to be lodged with the subscriber not later than 10 a.m., Friday, 29th June, 1928.

The Town Council do not bind themselves to accept the highest or any Tender.

THOS. F. HENDERSON, M. Inst. C.E.,
Burgh Surveyor and Water Engineer.
Burgh Surveyor and Water Engineer's Office,
Town House, Aberdeen,
28th May, 1928. 8597

Greenock Harbour Trust.

ELECTRIFICATION OF THE GARVEL PUMPING STATION.

The Trustees of the Port and Harbours of Greenock invite TENDERS for the following ENGINEERING WORK :—

Altering Two existing 24in. Centrifugal Dock Pumps from Steam to Electric Drive; alternatively, Supplying Two New Electrically Driven Pumps; Supplying Electrically Driven Hydraulic Pumps to Replace Existing Steam Plant; Minor necessary Auxiliaries.

Specifications and forms of Tender may be obtained from the Trust's Consulting Engineer, Mr. A. Leitch, B.Sc., A.M.I.C.E., at 65, Bath-street, Glasgow, on deposit of Two Guineas, which will be returned to offerers submitting bona fide Tenders.

Tenders should be returned to the undersigned in sealed envelopes, marked "Garvel Dock Plant," so as to arrive NOT LATER THAN TWELVE O'CLOCK NOON on MONDAY, THE 2nd of JULY, 1928. The Trustees do not undertake to accept the lowest or any Tender.

H. GOUGH GILCRIEST,
General Manager and Secretary.
Wallace-square,
31st May, 1928. 8639

Parish of Stepney.

STEAM JACKETED BOILING PANS.

The Guardians of the Parish of Stepney invite QUOTATIONS for the PURCHASE of TWO STEAM JACKETED BOILING PANS for installation in their Institution at South Grove, E. 3.

A form of Tender and specification may be obtained upon application at the Administrative Offices, and must be delivered to me in an envelope marked "Steam Jacketed Boiling Pans," and reach these offices by not later than 1 p.m. on Thursday, 7th June, 1928.

By Order,
S. McCLELLAND,
Clerk to the Guardians.
Administrative Offices,
Bancroft-road, Mile End, E. 1,
24th May, 1928. 8622

Parish of Stepney.

FOUL LINEN WASHING MACHINE.

The Guardians of the Parish of Stepney invite QUOTATIONS for the PURCHASE of a FOUL LINEN WASHING MACHINE for installation in their Institution at South Grove, E. 3.

A form of Tender may be obtained upon application at the Administrative Offices, or will be forwarded upon receipt of a stamped addressed foolscap envelope.

The form of Tender must be returned to me in an envelope marked "Foul Linen Washing Machine," and reach these offices by not later than 1 p.m. on Thursday, 7th June, 1928.

By Order,
S. McCLELLAND,
Clerk to the Guardians.
Administrative Offices,
Bancroft-road, Mile End, E. 1,
24th May, 1928. 8623

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PUBLIC NOTICES

South Indian Railway Company, LIMITED.

The Directors are prepared to receive TENDERS for the SUPPLY of TWO TWIN-SCREW FERRY STEAMERS for the service between India and Ceylon (Dhaneshkodi and Talaimannar).

Specification, drawings, conditions of contract, and form of Tender will be available at the Company's Offices, 91, Petty France, Westminster, S.W. 1.

Tenders, addressed to the Chairman and Directors of the South Indian Railway Company, Limited, marked "Tender for Ferry Steamers," must be left with the undersigned not later than 1 p.m. on Friday, the 27th July, 1928.

The Directors do not bind themselves to accept the lowest or any Tender.

A charge of £5 5s. will be made for plans and specifications, copies of which may be obtained at the offices of the Company, 91, Petty France, Westminster, S.W. 1.

This charge will be refunded to unsuccessful tenderers provided a bona fide Tender has been submitted and plans and specifications returned.

A. MUIRHEAD,
Managing Director.

91, Petty France, Westminster, S.W. 1,
25th May, 1928. 8598

South Indian Railway Company, LIMITED.

The Directors are prepared to receive TENDERS for the SUPPLY of :—

1. PLATELAYERS' TOOLS.
2. EMMERY CLOTH.
3. WOOD HANDLES.

Specifications and form of Tender will be available at the Company's Offices, 91, Petty France, Westminster, S.W. 1.

Tenders, addressed to the Chairman and Directors of the South Indian Railway Company, Limited, marked "Tender for Platelayers' Tools," or as the case may be, must be left with the undersigned not later than Twelve Noon on Friday, 15th June, 1928.

The Directors do not bind themselves to accept the lowest or any Tender.

A charge, which will not be returned, will be made of 5s. for each copy of the Specification No. 1, and of 2s. 6d. for each copy of Specifications Nos. 2 and 3.

A. MUIRHEAD,
Managing Director.

91, Petty France, S.W. 1,
1st June, 1928. 8646

The Madras and Southern MAHRATTA RAILWAY COMPANY, Limited,

invite TENDERS for :—

(1) GIRDER BRIDGE SPANS of 81ft., 10ft., 20ft., 30ft., and 40ft. (approximate total tonnage equals 213 Tons).
(2) 5 FOOTBRIDGES (75ft. centres of Stairways), complete with STAIRWAYS and ROOF COVERINGS (approximate total tonnage equals 160 Tons).

Tenders are due in as follows :—
No. (1) by 10.30 a.m. on Wednesday, 20th June, 1928.
No. (2) by 2 p.m. on Tuesday, 19th June, 1928.

Tender forms obtainable at address below ; fee One Guinea each, which is not returnable.

The Directors do not bind themselves to accept the lowest or any Tender.

Company's Offices :
25, Buckingham Palace-road,
Westminster, S.W. 1. 8592

The Yorkshire Electric Power COMPANY.

TENDERS are INVITED for the PURCHASE of the following SURPLUS PLANT :—

Lot 1.—Four Babcock and Wilcox Boilers.
Lot 2.—Two Clarke-Chapman-Woodeson Boilers.
Lot 3.—Two Boiler Feed Pumps.
Lot 4.—One Feed Water Heater.
Lot 5.—Three Forced Draught Fans.
Lot 6.—Two Steam Separators.
Lot 7.—One Rotary Sand Filter.
Lot 8.—One Babcock and Wilcox Gravity Bucket Conveyor.
Lot 9.—Two Cast Iron Tanks.
Lot 10.—Approximately 107 Tons of Steel Work.
Lot 11.—Various Main Steam Pipes and Valves.
Lot 12.—Three B.T.H. 1500-kW Vertical Turbo-Alternators, 10,000-11,000 volts, complete with Surface Condensers and Auxiliaries.
Lot 13.—Three Allen-B.T.H. 150-kW Engines and D.C. 220-volt Dynamos.
Lot 14.—One Horizontal Surface Condenser.
Lot 15.—Three Evans Hydraulic Pumps with B.T.H. Motors.
Lot 16.—Two Pumps.
Lot 17.—One Hydraulic Accumulator, 600 lb. per square inch.
Lot 18.—One 25 H.P. English Electric 220-volt D.C. Motor.
Lot 19.—One 27 H.P., B.T.H. 210-220 volt D.C. Motor.
Lot 20.—Four Oil Tanks.
Lot 21.—Two B.T.H. Remote-control Oil Switches, 500 ampere, 11,000 volt.
Lot 22.—Thirteen B.T.H. Remote-control Oil Switches, 300 ampere, 11,000 volt.
Lot 23.—Various Main Steam Pipes, Hydraulic Pipes and Valves.
Lot 24.—Approximately 40 Tons of Scrap Metal.
Lot 25.—One Brown-Boveri 4000 kVA Alternator with Bed-plate, but without Exciter.
Lot 26.—One Reciprocating Boiler Feed Pump.
Lot 27.—One Centrifugal Pump direct coupled to Steam Turbine.
Lot 28.—One Air Compressor.
Lot 29.—One Forced Draught Fan.
Lot 30.—Two Water Meters.
Lot 31.—One 18in. Non-return Valve and Strainer.
Lot 32.—One Surface Condenser.
Lot 33.—One Centrifugal Pump.

Further particulars of the above plant, which may be inspected by appointment, can be obtained on application. Offers will be considered for the whole of the plant or in lots as desired by buyers.

All communications to be addressed to :
THE GENERAL MANAGER,
THE YORKSHIRE ELECTRIC POWER CO.,
8558 36, Park-place, Leeds.

Metropolitan Borough of GREENWICH.

APPOINTMENT OF BATHS SUPERINTENDENT.

The Council of the Metropolitan Borough of Greenwich is prepared to receive APPLICATIONS for the APPOINTMENT of a SUPERINTENDENT ENGINEER at the Public Baths and Wash-houses, Trafalgar-road, Greenwich.

The inclusive salary will commence at the rate of £400 per annum, rising by three annual increments of £20, £20 and £10 respectively to a maximum of £450 per annum, with residence, fuel and light.

The appointment will be subject to the provisions of the Council's Superannuation Act.

Applicants must be duly qualified engineers and have had experience in Electrical Plant and in the management of a Public Baths Establishment.

Applications must be in the handwriting of the applicants on forms to be obtained from the undersigned and must be accompanied by copies of not more than three recent testimonials, such applications to be sealed and endorsed "Baths Superintendent," and must be received here not later than 10 a.m. on Monday, the 18th June, 1928.

The appointment will be terminable by one month's notice in writing on either side. Canvassing members of the Council, either directly or indirectly, will be a disqualification.

Stamped, addressed foolscap envelope must accompany application for form.

FREDERICK J. SIMPSON,
Town Clerk.

The Town Hall,
Greenwich-road, S.E. 10,
24th May, 1928. 8608

A Biography which every Engineer should Read and Own.

SIR ALFRED YARROW

HIS LIFE AND WORK. By LADY YARROW.

Popular Cheap Edition, with 77 Plates, many Coloured, 5s. net.

Young engineers and all those commencing their careers will find example and encouragement in this life-story of the great marine engineer and inventor. The price of this handsome book brings it within reach of all.

LONDON EDWARD ARNOLD & CO 41 & 43 MADDOX ST. W.1

PUBLIC NOTICES

City of Rochester. STROOD WATERWORKS.

APPOINTMENT OF ENGINE DRIVER.

The Corporation invite APPLICATIONS for the APPOINTMENT of ENGINE DRIVER at their Pumping Station, Strood Hill, at an inclusive wage of £2 10s. per week.

Applicants must be between the ages of 30 and 45 years old.

They should have had experience of Pumping Plant, Suction Gas Engines and Producers, also Steam Engines and Boilers, and be competent to do running repairs. None but first-class men need apply.

The appointment will be made subject to the provisions of the Local Government and other Officers' Superannuation Act, 1922, and the successful candidate will be required to pass a medical examination.

House, fuel and light provided, and six days' holiday with pay after 12 months' service will be granted.

Applications, in candidates' handwriting, stating age, whether married, details of experience, present and past appointments, and accompanied by copies of two recent testimonials, must be delivered to the undersigned on or before first post, Monday, 11th June, 1928, endorsed "Engine Driver."

Canvassing, either directly or indirectly, will be a disqualification.

JOHN L. PERCIVAL,
Town Clerk.

Guildhall, Rochester,
25th May, 1928. 8606

Synthetic Ammonia and NITRATES, Ltd.

(associated with Imperial Chemical Industries, Ltd.), REQUIRE the SERVICES of SEVERAL DRAUGHTSMEN for each of the following classes of work :—

1. Structural Draughtsmen ; calculation and design of Steel-framed Buildings and Structures.
2. Building Draughtsmen ; design of Brick Buildings, Temporary Timber Buildings, Roads and Drains.

Applicants must possess first-class experience of the class of work in which application is made, and the salary offered will be between £250-£400 per annum.

Duties will commence in the drawing-office, but each post carries good prospects of promotion, which will be entirely dependent upon ability and personality. Age 25-35.

Replies to be addressed to the CHIEF ENGINEER, Synthetic Ammonia and Nitrates, Ltd. (associated with Imperial Chemical Industries, Ltd.), Billingham, Stockton-on-Tees. 8638

SITUATIONS OPEN

COPIES OF TESTIMONIALS, NOT ORIGINALS, UNLESS SPECIFICALLY REQUESTED.

WANTED, CHIEF ENGINEER for Iron and Steel Works. Must be conversant with up-to-date practice and thoroughly experienced in reconstruction work.—Address applications, which will be treated in confidence, P4546, The Engineer Office. P4546 A

ASSISTANT ENGINEER REQUIRED, Age 25 to 30, with Shop and Office experience.—Address, stating age and salary expected, 8604, The Engineer Office. 8604 A

REPRESENTATIVE for North of England, to Call on engineers and manufacturers for Die Castings, &c. Engineering training essential.—Address, 8602, The Engineer Office. 8602 A

SUPT. of DEPT. WANTED, to Control Jig and Tool Design and Manufacture, Processing and Rate Fixing. High salary paid to a good man.—Address, stating age, experience, and where such has been gained, 8576, The Engineer Office. 8576 A

TRAVELLER, with Knowledge of Engineering applied to Domestic and Commercial Buildings and having connection among architects, London district, REQUIRED for progressive Firm Heating Engineers. Good opportunity for man of personality.

Also DRAUGHTSMAN, capable of designing Heating Schemes and taking-off quantities. Permanency with good prospects for smart man.

Address, stating age, experience, and salary required, 8634, The Engineer Office. 8634 A

WANTED, CENTRIFUGAL and TURBINE PUMP DESIGNER and DRAUGHTSMAN, capable of producing efficient High and Low-lift Pumps at competitive prices with modern equipment. State experience and salary required.—Address, 8448, The Engineer Office. 8448 A

WANTED, DRAUGHTSMAN, Experience in Quantities and Detailing Contractors' Temporary Works. Accurate, quick. State age, experience, salary required.—Address, 8629, The Engineer Office. 8629 A

WANTED IMMEDIATELY, DRAUGHTSMAN, accustomed to the designing of Pneumatic Drills and Hammers.—Address, giving experience, names of previous employers, and salary required, 8625, The Engineer Office. 8625 A

WANTED, SIX Live DRAUGHTSMEN, Accustomed to the design of Water-tube Boilers, Superheaters, Economisers, &c., who are required to commence work immediately on important contracts. Persons without above training will not be considered.—Address in first instance, 8539, The Engineer Office, stating salary, age and past experience, also earliest date when duties could be commenced. 8539 A

AN OPENING OCCURS in a Large Engineering Works in the Midlands for an experienced CONVEYOR DRAUGHTSMAN for Surveying Works, Preparing Schemes and Estimates and Submitting Proposals of Conveyor and Handling Schemes. The post is a progressive one, and offers good scope for ability and energy. Only men of sound experience in conveying and elevating work need apply. Commercial experience will be an advantage.—Write, stating full particulars of past experience, age, salary desired and when at liberty, to 8533, The Engineer Office. 8533 A

DRAUGHTSMAN and DESIGNER, Specialising in Lattice Tower Work, with practical experience, WANTED in West of England.—Address, stating age and qualifications and salary required, P4571, The Engineer Office. P4571 A

DRAUGHTSMAN, Intelligent, with Experience in High Compression Heavy Oil Engines. State age, experience, and salary required.—Address, 8645, The Engineer Office. 8645 A

DRAUGHTSMAN REQUIRED by Steel Works Engineers ; knowledge of Furnaces, Gas Producers essential. State age, previous experience, and salary required.—Address, 8619, The Engineer Office. 8619 A

SITUATIONS OPEN (continued)

DRAUGHTSMAN REQUIRED, to Take Charge of Production Drawings in works employing about 700 hands, making very accurate machinery. Progressive position for a young man with plenty of energy. Only those who have had workshop experience will be considered.—Address, stating age, experience, and salary required, 8600, The Engineer Office. 8600 A

DRAUGHTSMAN REQUIRED with First-class practical and theoretical training and with considerable experience in the design and installation of plant for a large engineering factory. Applicants must give full details of experience and training and enclose copies of recent testimonials, and should state age, salary required, and when at liberty to start.—Address, 8605, The Engineer Office. 8605 A

DRAUGHTSMAN. — SENIOR DRAUGHTSMAN WANTED for Structural Works. Able to economically design Steel-framed Buildings, &c., and make working drawings for shops. None but those fully experienced in this class of work need apply. Give full particulars.—REES and KIRBY, Ltd., Morriston, Swansea. P4574 A

DRAUGHTSMAN WANTED, Experienced in Structural and Mechanical Work in connection with Coal-handling Plants. Experienced men only need apply. State age, experience, and salary required.—Address, 8643, The Engineer Office. 8643 A

DRAUGHTSMAN, with First-class Experience of Steam Turbine design and Detail Work, for works in Midlands. State age, salary, experience, and when able to commence.—Address, 8631, The Engineer Office. 8631 A

DRAUGHTSMEN, Jig and Tool, WANTED AT ONCE.—Apply, giving all particulars, to DRAUGHTSMAN, Works Office, Westwood Works, Peterborough. 8624 A

DRAUGHTSMEN (Junior) WANTED for Engineering Works in South of England. State age, experience, and wages required.—Address, 8620, The Engineer Office. 8620 A

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For continuation of Small Advertisements see page 4.

A Seven-Day Journal

A Wire Rope Manufacturers' Federation.

WE learn that a new body, known as the Federation of Wire Rope Manufacturers of Great Britain, has recently been formed, and that a full statement of its objects will be issued shortly. The prime endeavour of the Federation will be to ensure that the high standard of quality and trustworthiness of product for which the leading British ropemakers are renowned shall be maintained. The maintenance of that standard, it is stated, has been placed in jeopardy by reason of the fact that the prices now being obtained for wire ropes are being forced down to a level at which it is impossible for any maker to give of his best. The lowest price, it is asserted, is becoming the only factor that counts among buyers of wire ropes, and first-class makers, without being relieved of the responsibilities to those whose lives depend on the trustworthiness of their ropes, are being pitted against each other on price and are being forced down to figures which are unjustifiable and for which there is no excuse. The position has for some time been viewed by the manufacturers with alarm, and as a consequence they have formed the new body. The secretary of the Federation is Mr. E. J. W. Buckpitt, and his offices are at 16A, St. James's-street, London, S.W. 1.

U.S. Naval Programme Delayed.

A "SNAP" vote taken in the Senate on May 26th resulted in the defeat of the United States Naval Supply Bill by 44 votes to 22. This unexpected result was due to the absence of numerous members who are supporters of the Bill, but who did not anticipate that it would come up for decision at that particular moment. In consequence of the adverse vote, the Bill must now be held over until Congress is reconvened in December next. No funds, therefore, will be available for beginning work on the new building programme, which calls for the construction of five cruisers each year in 1929, 1930, and 1931, and one aircraft carrier. The Navy Department, it is reported, had intended to place contracts for the first five ships during the autumn, to make sure of their being laid down in the first half of next year. This is no longer possible, and it is feared that the first group of vessels may be delayed. All advices from Washington indicate that the Bill will be passed next December, the present check having resulted from a political manœuvre which had no connection with the merits of the measure itself. Meanwhile the Navy Department is seeking authority to amplify the programme by three flotilla leaders and two fleet submarines, this extra tonnage being regarded as a partial substitute for twelve destroyers and three submarines which, although sanctioned under the 1916 building scheme, have never been laid down. The type of flotilla leader which finds most favour among American naval officers has a displacement between 2500 tons and 3000 tons, a speed of 36 knots, and a main armament of four 6in. guns on twin mountings. A small aeroplane is included in the equipment.

Hydrogenation of Coal in Germany.

ACCORDING to a statement made by Dr. Carl Bosch, chairman of the German Dye Trust, at a shareholders' meeting last week, great progress is being made by the Trust in establishing its coal liquefaction process on a commercial basis. Since the autumn of last year the Trust had, Dr. Bosch stated, been marketing synthetic benzine and had found no difficulty in disposing of its output. The total quantity to be produced this year was expected to amount to 100,000 tons, while next year it would reach 200,000 tons, the increase being achieved, not by an enlargement of the works, but by an improvement of the process employed, which would enable the existing plant to yield a much higher production. The Trust, Dr. Bosch continued, would shortly undertake the hydrogenation of anthracite, and was making good progress with the synthetic production of lubricating oils and paraffin. It already used its own synthetic lubricants, and had found them satisfactory in all respects. In conjunction with the Standard Oil Company, the Trust was erecting an experimental hydrogenation plant in the United States. The Trust, in addition to dealing in dyes and manufacturing oils by the hydrogenation of coal, produces viscose artificial silk and owns mines and other auxiliary business. Altogether, it now employs 143,000 persons.

The Watch and Clock Industry.

AT one period of last century this country enjoyed a high reputation and a large trade in the manufacture of clocks and watches. The reputation remains but the trade has departed to a very considerable extent to other countries, chiefly Germany, Switzerland and the United States. To-day about 17,000 workers are engaged in the British watch and clock industry, but most of them are employed on repairing rather than on production. Further, in those cases in which production is carried out, the work is largely conducted by means of parts imported from abroad. It is to be regretted for sentimental reasons that the British watch and clock industry, with its world-wide reputation for high-class workmanship and its extensive contributions to horological history, is no longer what it was. From the purely commercial point of view, however, we need shed few tears over the departure of the trade from our midst. So at least we are led to conclude from a statement regarding the fortunes of the industry in one of the countries—Germany—which helped to deprive us of our former outstanding position. The German watch and clock industry is stated to employ about 20,000 hands, to represent a capital investment of about 100,000,000 marks, and to export about 65 to 70 per cent. of its production. The value of the exports is said to be about 55,000,000 marks a year, or about 60 per cent. of the total turnover. It would appear therefore that the total annual turnover is about 92 per cent. of the capital invested in the industry. Nevertheless, the profits are apparently very small, amounting, it is said, to not more than 2 per cent. In order to improve the commercial side of the business efforts, we learn, are now being made by five of the leading German works to conclude an agreement establishing a community of interest and, in conjunction with the retailers, to establish regulated wholesale and retail prices. The support derived from the home market has for some time past kept the German industry in existence, but should it be withdrawn or reduced, the manufacturers will probably seek to regulate output as well as prices.

The Late Herr Felix Deutsch.

THE recent death of Herr Felix Deutsch, which occurred within less than a week after the celebration of his seventieth birthday, has deprived the Allegemeine Electricitäts Gesellschaft of a valued chairman and Europe of a commercial electrical engineer of international repute. Felix Deutsch was born in Breslau in 1858, and after leaving school was apprenticed at an early age to a firm which manufactured sugar machinery. After the Franco-German War he became interested in banking, and in 1882 settled in Berlin. About that time he met Emil Rathenau and took part in the financial negotiations connected with the German Edison Company. In 1884 he was made a director of the company, and when in 1887 the A.E.G. was formed he took charge of its sales department. The world-wide activities of the A.E.G. to-day may be said to have been built up largely by his initiative and industry. He travelled widely and, in particular, he had an extensive knowledge of Russia, which enabled him to play an important part in concluding the Treaty of Rapello. He consistently advocated the renewal of trade interests between Germany and the countries which had become estranged during the war. Herr Deutsch took a prominent part in the negotiations which led to the granting of trade credits to Russia, and was among the earlier German industrialists to reopen relations with the United States. More recently he co-operated with a committee which was formed to bring about better industrial relations between France and Germany. His long friendship with the late Emil Rathenau was extended to Walter Rathenau, with whom he shared a strong opposition to trusts of the "vertical" type, such as the Stinnes group. He equally favoured, however, "horizontal" amalgamations, such as the A.E.G. group, which within recent years have played an important part in placing German industry on a sounder basis. On the death of Walter Rathenau, Herr Deutsch became the chairman of the board of the A.E.G.

The Electrical Industry.

ACCORDING to the *Trade Survey*, the quarterly journal published by the British Electrical and Allied Manufacturers' Association, the electrical supply industry showed a record increase in output during 1927. The increase is attributed partly to the recovery of ground lost during 1926, as the result of depressed trade conditions and partly to the beginning of a real recovery in production in this country. Owing to the improvement, the electricity generated by statutory, non-statutory and railway authorities, rose from 8367 million units to slightly over 10,300 million units. As regards plant, however, a calculation recently made showed that owing to the ultra-cautious policy on the part of supply undertakings, for which justification could be found in the preparations for the national reorganisation of electricity supply, the installation of generating plant has not kept pace with the increase in the consumption of electricity. There is now, it is stated, a real deficiency of at least half a million kilowatts of generating plant. In the London area very serious delays have taken place in connection with the erection of the new super-power stations, and there appears to be some doubt as to whether existing plant will suffice to meet the rapid increase in load. A study of the electricity production statistics for the United States, Canada, Germany and Italy shows that, with the possible exception of Canada, British production advanced more rapidly in 1927 than production in any of these other countries. In exports, Great Britain more than held her own during 1927. In the first six months of the year especially, orders for heavy generating plant and equipment were very much in excess of those recorded during the corresponding period of 1926, but from August onwards a lull took place in export activity, and has since continued with little indication of improvement. The main centre of competition in 1928, it is considered, will not be Germany, but rather the United States, since manufacturers in that country will show increased interest in developing the export trade to make good the fall in home demand.

The Mersey Dock Board Engineer.

AT the weekly meeting of the Mersey Dock and Harbour Board, which was held on Thursday, May 24th, Mr. Thomas L. Norfolk, who has served the Board for some years as principal assistant to the engineer-in-chief, Mr. T. M. Newell, was appointed Engineer-in-Chief, as and from July 2nd next, when Mr. Newell retires. In recommending the selection of Mr. Norfolk by the Works Committee, Mr. H. B. Gordon Warren referred to the new engineer's earlier training. Mr. Norfolk was first a pupil to a mechanical engineer, and after eight years in the works and drawing-office, he went to sea as a marine engineer. He then became a pupil of the late Mr. Bohn, a civil engineer, and on finishing his three years of training, became residential engineer for two years on the River Humber Reclamation Scheme. He afterwards served for ten years on the dock engineer's staff of the North-Eastern Railway Company, and gained experience on dock construction and maintenance at Hull, West Hartlepool, Middlesbrough and Newcastle. Mr. Norfolk entered the service of the Mersey Dock Board in 1914, and six years later became the principal assistant to Mr. Newell, with whom he has worked throughout the period of construction of the new Gladstone Docks. Mr. Norfolk is a member of the Institution of Civil Engineers and of the Institution of Mechanical Engineers, and an associate member of the Institution of Electrical Engineers. The Committee gave expression to its gratification on being able to elect to the vacant post a member of its own staff. As stated in a Journal Note on January 13th last, Mr. Newell, when he retires at the end of June, will not sever his connection with the Board, but will continue to act as its consulting engineer.

A French Electrical Trust.

NEW indications of the efforts being made by American interests to establish an international electric trust are to be found in the amalgamation of the two principal French electrical manufacturing companies, the Société Alsacienne de Constructions Mecaniques and the Compagnie Thomson-Houston. With a total combined share capital of 415 million francs, these two firms are responsible for almost 40 per cent. of the French national output of electrical and allied machinery and apparatus, and through existing agreements with other companies —notably, the Compagnie Générale d'Electricité— they are in a position to exert effective control over something like 60 per cent. Hence, foundations have been laid for a great French electrical trust under American influence and to some extent financial and technical control. Whilst the two firms will remain nominally as at present, a new company will be formed with a total capital of 400 million francs, of which 250 million francs will be devoted to the acquisition of manufacturing plant, stocks, and orders in hand, while the remaining 150 million francs will constitute liquid capital necessary to finance production. The new company will acquire from the Société Alsacienne the manufacturing works at Belfort and from the Thomson-Houston Company the factories at Saint-Ouen, Colombes, Lecourbe, Jarville and Lesquin, and will take over the patent and other rights already ceded to those two companies by the General Electric Company of America. The capital of the holding company will be split equally between the two firms, and the profits from the special manufactures carried out by the new company will be distributed equally between the two founder firms.

The Late Mr. A. R. Bennett.

MANY of our readers, particularly those connected with the telephone industry, will regret to learn of the death, on May 24th, at Matlock, of Mr. Alfred Rosling Bennett. Mr. Bennett was born in London in 1850. His first important post in which he was brought into contact with the development of the telephone industry was the position of general manager and chief engineer for Scotland and the North of England to the National Telephone Company. He held that post from 1883 to 1890, and subsequently occupied similar positions with the Mutual Telephone Company and the New Telephone Company. At later dates he served as engineer to the municipal telephone exchange systems at Glasgow, Guernsey, Portsmouth, Hull, Brighton and Swansea. As an inventor he was responsible in 1880 for the telephonic translator, the caustic alkali and iron battery in 1881, and the convection mill in 1896. He wrote frequently on telephonic and other electrical subjects, and also upon locomotives and railways, in which he was greatly interested. He was a member of the Institution of Electrical Engineers and a past Vice-president of the Institution of Locomotive Engineers. In recent years he resided at St. Peter Port, Guernsey.

WOODBRIDGE ROAD ELECTRIC GENERATING STATION, GUILDFORD

FIG. 1—EXTERIOR OF STATION SHOWING COAL HANDLING PLANT

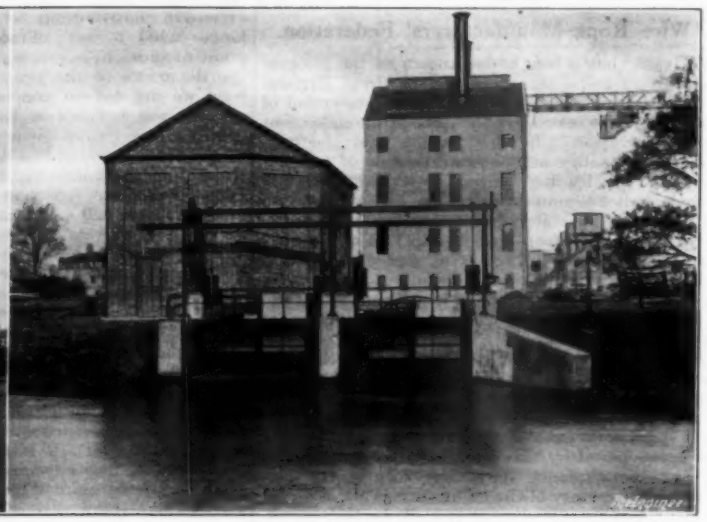


FIG. 2—CIRCULATING WATER INTAKE AND PUMP HOUSE

A New Electric Generating Station at Guildford.

No. I.

FOR over thirty years, to be precise ever since 1896, Guildford, the county town of Surrey, has had an electricity supply, but it was not until the year 1920, when it was taken over by the Corporation, that the undertaking really began to make headway. The original supply company, which at the time of its inception was the smallest concern of the kind in this country, does not, on the whole, appear to have enjoyed a very prosperous existence, and at the termination of the war it entered upon a very bad period. Owing to various causes, with which we need not deal, the supply frequently failed, a state of affairs that seems to have been largely responsible for the Corporation's desire to acquire the undertaking. Steps were taken as soon as the concern changed hands to rearrange the whole scheme—to plan a new station equipped with modern turbine machinery on a favourable site. Some idea of the adverse conditions under which the old station worked can be gained from the fact that not only was the plant old and inefficient, but there were no spare machines at all, nor was there space to accommodate any. The original distribution system was unique; nothing, in fact, quite like it existed elsewhere in the country, for the mains were laid on the concentric system with a bare copper neutral buried direct in the ground. Now, however, Guildford has a supply system that conforms with modern ideas and a new and very well designed generating station which was officially opened last Wednesday.

This station, which was, of course, sanctioned by the Electricity Commissioners—who, it is to be hoped, will also sanction extensions when they become necessary—is erected on an ideal site at Woodbridge-road, adjacent to the river Wey and the Southern Railway, whilst the original generating station in Onslow-street has been turned into a converting station. The turbine room is shown in Fig. 3, whilst the drawings Figs. 4 and 5 give a fair idea of the general design of the station and show the arrangement of the generating units and boilers. Although, at present, there are only two 1500-kW and one 3000-kW generating units, the building is designed so that it can be extended for an ultimate capacity of 42,000 kW. With the details of the existing plant in the turbine room we shall deal in our next issue. All the turbo-generators are designed for a speed of 3000 revolutions per minute, a stop valve pressure of 250 lb. per square inch, 700 deg. Fah. stop valve temperature, and a vacuum of 28·5in. at full load, with a cooling water temperature of 70 deg. Fah.

BUILDINGS.

The contract for the complete station was placed with C. A. Parsons and Co., Ltd., of Newcastle-on-Tyne, who carried out the work in a very short space of time. The foundation work began in January, 1927, whilst the first machine was put into operation in the following November. Needless to say, the completion of the new station was a great relief to the Guildford Electricity Committee and officials, who had previously to rely upon the old and unsatisfactory plant in the original generating station at Onslow-street. The

FIG. 3—INTERIOR OF TURBINE ROOM

building work involving the construction of the foundations both for the building itself and the turbines, the complete construction of the turbine room and boiler-house, two reinforced concrete ash bunkers, a coal bunker, the intake chamber and pump house—see Fig. 2—and the discharge bay, was sublet to Industrial Constructions, Ltd. The main building stands on concrete foundations which extend down to a depth of 12ft. It is a steel-framed structure with brick filling and artificial stone dressings, the front and side elevations being rendered in Atlas white cement. The steel work for the structure was supplied by Dawnay and Sons, Ltd. The roof of the building is covered with "rustic" asbestos cement slates with

patented lead glazing for lighting. On the Woodbridge-road the frontage is 67ft. 7in., whilst the depth back is 177ft. 8in. On one side of the structure in front of the engine and switch house there is a two-storey block of offices with a frontage of 51ft. in the offices the floors are paved with 1¼in. oak blocks. Inside the power station the walls are lined with white tiles and glazed bricks.

STEAM-RAISING PLANT.

For the construction and erection of the steam-raising, coal and ash-handling plant the Stirling Boiler Company, Ltd., was responsible. From a storage dump the coal is picked up by an overhead telpher, tri-drum water-tube boilers, each capable of evaporating 40,000 lb. of water per hour to steam at 290 lb. per square inch and superheated to 750 deg. Fah. and with an overload capacity of 52,000 lb. per hour, have been installed. The boiler, superheater, and economiser are set as one steel-cased unit, a very compact and efficient arrangement which obviates the employment of long flues and consequent air

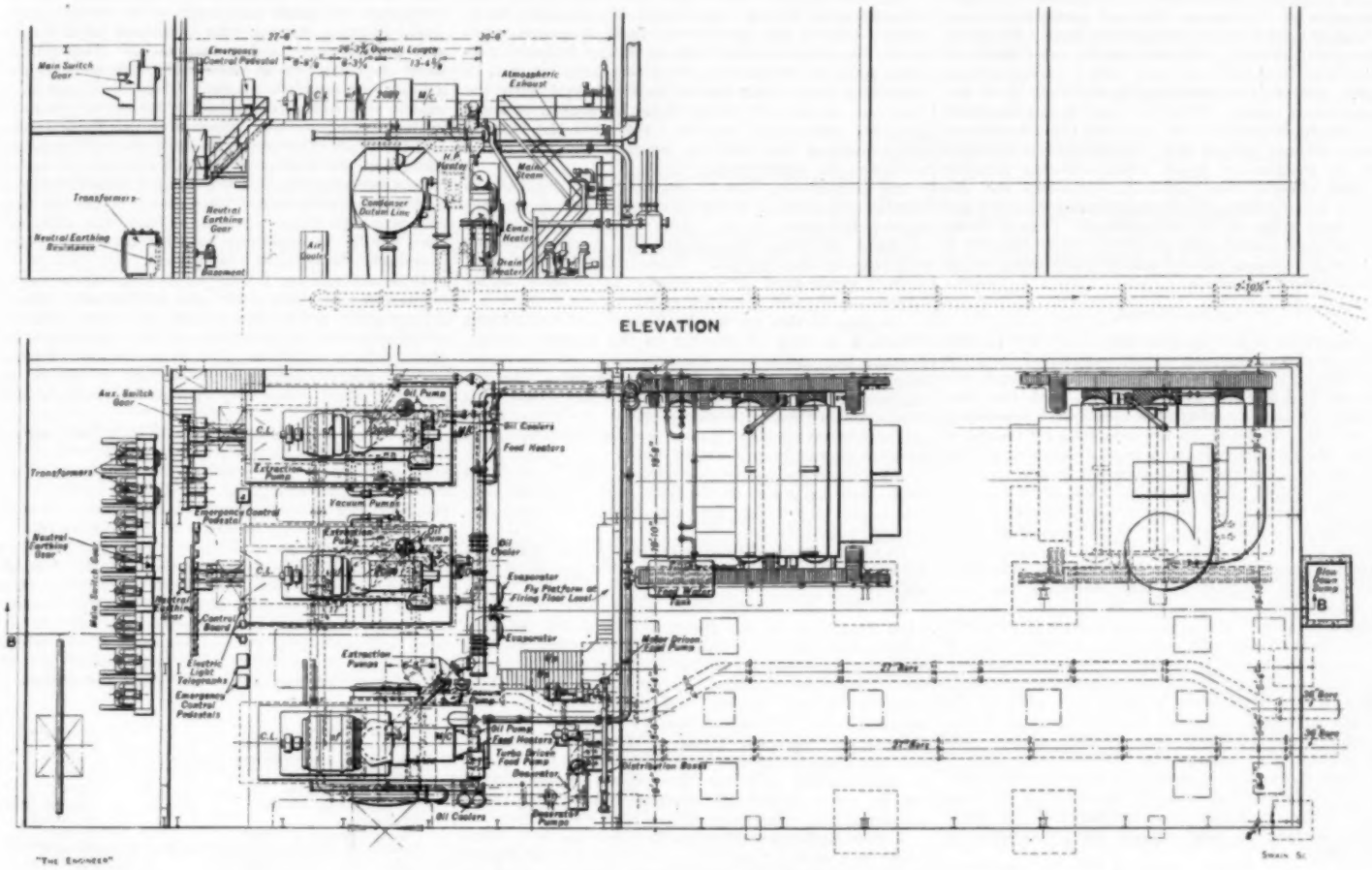


FIG. 4—ELEVATION AND PLAN OF WOODBRIDGE ROAD GENERATING STATION

and a height of 23ft. The dimensions of the boiler-house are 88ft. wide, 61ft. deep, 70ft. high to the eaves, and 95ft. to the ridge. The turbine room has the same depth as the boiler-house and it is 59ft. wide, whilst the switch house is 18ft. wide. The power station floors are of reinforced concrete 6in. thick; to be seen in Fig. 1, and is transported to the boiler-house bunkers from which it is supplied to the boilers through duplex valves. Two of the latest type Stirling leakage. Soot blower elements are provided for removing deposits from the boiler and economiser tubes. Each boiler has its own chimney and elec-

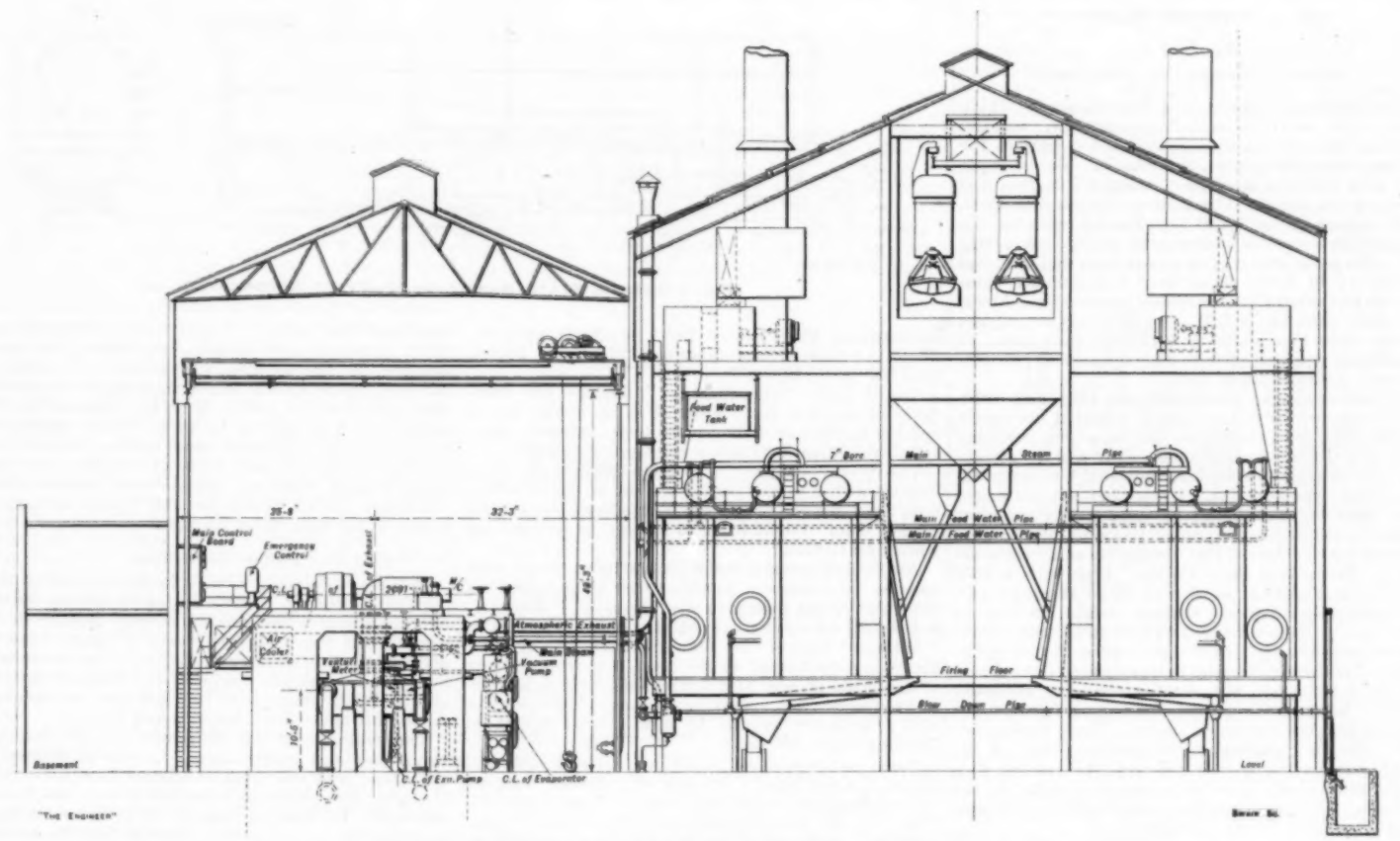


FIG. 5—SECTION THROUGH TURBINE AND BOILER HOUSES

trically driven forced and induced draught fans. The gases are discharged through grit arresters situated at the chimney bases, so that particles of dust are not discharged into the atmosphere, but are trapped and collected and are disposed of with the ash. Two travelling grate stokers, supplied by the Underfeed Stoker Company, are fitted to each boiler, giving a grate area of 210 square feet and permitting up to 3½ tons of coal to be consumed per hour. From the hoppers at the rear of the stokers the ash falls into a submerged drag link conveyor which carries it to a bunker outside the building, from which it is discharged into trucks. With this system the basement is, of course, kept free from dust and the ash removal is done without human aid. Each boiler is provided with an instrument panel with a steam pressure recorder, a boiler load indicator, recorders for CO_2 and CO, a temperature indicator for water, steam and gases, and a set of draught gauges. A coal meter fitted to each stoker gives a daily or weekly record of the coal consumption and allows short tests to be made whenever desired.

PUMP HOUSE.

Coming now to the pump house, which is to be seen in Fig. 2, the circulating water is obtained from the river Wey, and it enters the intake bay through two Ledward and Beckett rotary screens, each 10ft. 6in. in diameter and rotating at a speed of 1 revolution per minute. The screens are operated by means of Pelton wheels and reduction gear, the water supply being taken from the circulating water line main in the pump house. In the pump house there are two electrically-driven vertical-spindle centrifugal pumps, which were manufactured by the Pulsometer Engineering Company, Ltd. Each has a capacity of 250,000 gallons of water per hour against a head of 27ft., and they deliver the water through a 36in. cast iron main to the condensers in the turbine room at a distance of 450ft. From the condensers, the water is carried through a similar main to a discharge bay at the downstream edge of the site. Provision has been made on the intake pipe for six additional circulating pumps when extensions become necessary. The quantity of water circulated per minute in each condenser for the 1500-kW sets is 2280 gallons and 3890 gallons in the case of the 3000-kW set. Each of the three Parsons' condensers is built on the three-flow principle with tubes having an external diameter of ¾in. The condenser for the 3000-kW set has a cooling surface of 4340 square feet, composed of 1925 tubes.

(To be continued).

General Development of the Locomotive.

(By a Continental Engineer).

No. VII.*

FRENCH LOCOMOTIVES (*continued*).

THE Western Company (now State Railway) which never built any "Atlantic" locomotives, was the first, in 1900, to put into service 4–6–0 engines for express trains, having 6ft. 5in. wheels. The example was soon followed and the "Atlantic" engines had a very short vogue. The Eastern Railway, in 1903, built engines of the 4–6–0 type having probably the largest wheels ever used for engines of this class (nearly 7ft.); the grate area was 34 square feet, and the total weight 74·40 tons; these were four-cylinder compounds like other French express locomotives. About the same time the P.L.M. put into service engines of the same type; last type (1908), grate area, 32 square feet; heating surface, 2400 square feet; weight, 73 tons; driving wheels, 79in.

All railways also built, between 1900 and 1910, 4–6–0 engines for mixed traffic, mounted on wheels of 5ft. 9in., but, thanks to the balancing resulting from the use of four-cylinders with cranks respectively at 180 deg. and 90 deg., they could, when necessary, haul express trains. It was then acknowledged that these engines, though having a nearly sufficient adhesive weight, had a rather too small grate area, at least for the class of fuel obtainable at a reasonable price. From 1910 the "Pacific" type with a wide fire-box and grate areas of from 43 to 46 square feet was generally adopted; average weight 95 tons to 100 tons; adhesive weight, 54 tons to 59 tons; driving wheels, 6ft. 2⅜in. to 6ft. 6in., all with four cylinders. The Nord Company built also very fine engines of the 4–6–2 type, but as that company generally burns a better grade of fuel, the narrow fire-box was maintained, but was made longer. These engines are not "Pacific" engines in the absolute sense of the word, not having a wide fire-box, the trailing axle being only used to avoid excessive weight on the drivers. The same company also built experimentally two huge "Baltic" engines.

A new step was made in 1925 by the P.L.M. and Eastern companies which have designed and built for their heavier express trains on the difficult sections some engines of the 4–8–2 type, their weight in working order being nearly 120 tons, and the adhesive weights respectively 74·4 and 74 tons. They can haul a train of 600 tons at a speed of 66 miles per hour.

The P.L.M., in 1907, and the State Railway of Italy were the first in Europe, I believe, to introduce the 4–8–0 type, especially designed for handling passenger trains in mountainous districts.

All the engines built since 1911 are fitted with superheaters, piston valves and Walschaerts valve gear. One of the noteworthy facts of recent years is the almost general giving up of the Belpaire fire-box, principally because, with powerful engines, it interferes more than the cylindrical type with the look-out, is heavier and perhaps by reason of some troubles experienced at one time with the flanged plate making the junction between the flat plates and the cylindrical shell.

As said above, French engines have generally a smaller diameter of boiler barrel than British engines having less grate area. This is partly the result of local practice, and, above all, of the necessity of reducing the weight. Thus, "Pacific" engines, with a grate area of 47 square feet, have boiler barrels of 5ft. 6in. diameter only.

In some of the engines built lately, the American influence is very observable in the general design, though the distinctive characteristics of European engines—boilers, frames, &c.—are retained. All the engines of the periods quoted above are fitted with compensating beams on all springs, so that the engines are supported on three points and the distribution of weights cannot be put out of order.

All French and many Continental engines are fitted with dumping grates at the front end of the fire-box, which are very handy for cleaning the fires and disposing of the clinkers.

In what concerns the general use of four cylinders, we cannot do more than refer to what has been said already.

The French railways have never been behind in what concerns the handling of long goods trains—I leave aside the American engines, of course, at least those built since about thirty-five years ago; a matter also discussed already. They have kept their position in this respect and own to-day a great number of "Consolidation," "Mikado" and "Decapod" engines. Some of the goods trains are now far from being slow—at least those not stopping at intermediate stations—their speed being limited less by the power of the engines than by the brake power, as it is everywhere but in the United States.

A few particulars concerning these engines, some being only used for goods trains, some, having wheels of at least 60in. diameter, being also intended for mixed traffic, suburban or long gradients service, will be found below.

The State Railway owns a number of "Consolidation" locomotives, two cylinders, simple, superheated steam, of a very straightforward design, neat and as plain as possible. Grate area, 34 square feet; heating surface, 1850 square feet; working pressure, 172 lb.; wheels 57in.; cylinders, 23½in. by 25⅝in.; tractive force, 42,000 lb.

The P.L.M. "Consolidation" engines are four-cylinder simples, same grate area as above and a heating surface of 1900 square feet; wheels, 59in.; cylinders, 18½in. by 25⅝in.; cranks at 180 deg.

The power of the "Consolidation" type being limited, as it does not permit the use of the wide fire-box, the "Mikado" type has been adopted by several roads. Total weight from 93 to 95 tons and driving wheels up to 65in.

All French systems make an extensive use of tank engines for suburban, goods or marshalling services. The most recent belong to the "Prairie," "Mikado," 4–8–4 (P.L.M.), or simple eight-coupled types. The "Mikado" type of the State Railway, two-cylinder simples, superheated steam, have a narrow fire-box with a grate area of 33·5 square feet; heating surface of 2440 square feet; working pressure, 172 lb.; wheels, 61in.; adhesive weight, 70 tons; total weight in working order, 95 tons.

Some companies, as, for example, the P.L.M. and Eastern, have built a number of "Baltic" engines of very large size, which are already sixteen years old. The P.L.M. locomotives are four-cylinder compounds; grate area, 34 square feet; heating surface, 3700 square feet; working pressure, 227·5 lb.; total weight, 104 tons. It is evident that the "Mikado" type is better suited for suburban services, as giving a larger adhesive weight for the same or even less total weight.

Most railways use now eight-coupled engines—sometimes "Decapods"—for shunting purposes; wheels, about 51in.; tractive effort at least 30,000 lb.; wheel base, 14ft. to 15ft. for the four-coupled type.

Whilst on this subject, and now that the Americans have put into service non-articulated locomotives having six coupled axles, it is interesting to recall that in 1862 Mr. Petiet, chief engineer of the Nord Company, designed and built some twelve driving wheel engines, having four cylinders, of a singular and unique type to-day forgotten. The cylinders were disposed two at each end, each pair of them driving six coupled wheels. Thus, each set of six wheels was independent of the other, which helped in negotiating curves. They were not freak engines, and for years they were allocated to coal trains from the North to Paris. Unhappily, these locomotives were tank engines, and the weight available for the boiler was insufficient. They were, of course, much less powerful than modern locomotives of such a class would be, especially in view of the maximum permissible weights at that period.

It is not useless, I believe, to recall these curious engines of sixty-four years ago, which came certainly a long while before their time, since the same kind of arrangement of cylinders and driving wheels may perhaps be revived one day. Was not the "Fairlie" engine almost forgotten when its principle was recently adopted for very special locomotives under another form?

Powerful tank engines have also been built recently of the same types, for suburban service as well as some eight-coupled—0–8–0—engines for shunting in large marshalling depôts. But the British railways keep their superiority for the swiftness and speed of shunting operations, not being impeded by old regulations.

We finish this short notice by giving in Fig. 1 the diagram and principal particulars of the standard "Pacific" locomotive of the State Railway of France, one of the most compact designs of to-day, thanks to the trapezoidal fire-box described above. It is a neat and well-proportioned engine. Four cylinder compound, two driving axles, large boiler having a cylindrical fire-box top. The chief particulars are as under:—

Tractive effort	31,100 lb.
Diameter, H.P. cylinders	16½in.
Diameter, L.P. cylinders	25½in.
Stroke of pistons	26in.
Working pressure	228 lb.
Total heating surface	2300 sq. feet.
Grate area	46 sq. feet
Weight, working order*	99 tons
Adhesive weight	58 tons
I.H.P.	2,200 H.P.
Diameter of driving wheels	6ft. 4 $\frac{7}{16}$in.

All tenders have their tanks of the horse-shoe pattern arranged above the frames, which is common practice on the Continent. With modern engines, they all run on six wheels or on two bogies. For long-distance expresses, their water capacity varies between

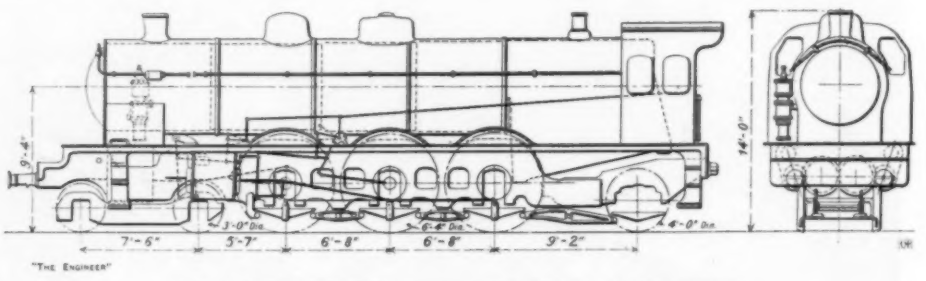


FIG. 1—FRENCH STATE RAILWAYS—"PACIFIC"—LOCOMOTIVE

4500 and 6000 gallons. One or two important roads have interchangeable tenders, not bearing the same numbers as the engines, which can be coupled to different types of locomotives, according to the immediate needs of the traffic or to the diameter of the turntables to be met on the way. Goods engines are often coupled to relatively small tenders, as they stop frequently and can take water at frequent intervals. Some French roads use special water cranes called "à grand débit," which are able to fill the largest tender in less than three minutes.

OTHER COUNTRIES.

Belgium.—Belgium, a very industrial and thickly populated country, owns a complete railway system offering probably the greatest average density in the world. She has been progressive in many respects, and was the first country on the Continent to use very heavy rails; she has produced the Belpaire fire-box and the Walschaerts gear, this last now the standard on all railways of both America and Europe.

The evolution of the locomotive, on Belgian railways, has been rather similar to that of France, in this sense, that the types of engines have often been changed, but probably more often than on French railways. In Belgium engines of home and foreign construction not materially different from those used elsewhere were employed. Then came a kind of standardisation, especially observable when all important railways were put under State management. All the engines of that period had inside cylinders, out-

* No. VI. appeared May 25th.

* The first engines of this class have a total weight of 96·5 tons and an adhesive weight a little under 56 tons.

side frames with one inside middle frame, and Belpaire fire-box extending over the trailing coupled axle in 2–4–0 locomotives, which were generally used for hauling passenger trains. Then came another period, in the 'nineties, when a number of engines, notably of the 2–4–0, 2–4–2, 2–6–0 types, &c., were built with the special aim of burning run-of-mine and fine coal, a rather strange idea in a country having important coalfields and some producing good grade fuel. These engines had very special proportions, wide but very shallow Belpaire fire-boxes, with an enormous grate area for their power—up to 74 square feet for a total weight of 62 tons. In order to get a very soft draught, necessary with the kind of fuel used, they had chimneys of an exceptional area, and, on some engines, of square section. During the following years, and for some time, Belgian practice was out of the orbit of other countries, indeed too much so to last.

Then came a reaction, absolutely complete, and British models, particularly Scotch, derived from the Caledonian Railway types, came into favour. In these new engines the Belpaire fire-box was done away with—not to reappear again—the frames were inside, as were the cylinders. These locomotives belonged to the 4–4–0, 4–6–0, and 0–6–0 types, tender or tank engines, the latter often of the 4–4–2 type. Weight from 53 tons to 70 tons, grate area not over 31 square feet. There were also built some "Atlantic" engines, rather on the French pattern, but this type of locomotive was not very suitable for the working conditions, on account of the small distances to be run without stops and the frequent startings. The 4–6–0 engines, of a very handsome appearance—type 35—were supported on 63in. driving wheels, had a total weight of a little over 70 tons, and could haul a passenger train of 375 tons at a speed of 25 miles per hour on a continuous gradient of 15°/₀₀. Other engines of the same type, having 67in. wheels, could haul a train of 350 tons at a speed of 43 m.p.h. on a gradient of 5°/₀₀.

These locomotives were the starting point—about 1905—of a new series of engines designed by the Belgian engineers, which were more powerful—76 tons for the 4–6–0 engines — very symmetrical, and accounted at their time amongst the most modern types. They had four cylinders, some simple, some double-expansion with cranks driving separate axles, at 180 deg.; wheels of respectively 78in. and 71in. grate area, 33 square feet; working pressure, 220 lb. for the compounds, 199 lb. for the simple engines; fire-box with round top; high pitched boiler; superheater.

Very soon after the Belgian State Railway ordered some very powerful passenger engines (4–6–2), and, for goods traffic of the 2–10–0 type, the first of this model in use in Europe, I believe. To sum up, Belgium has shown a great initiative and, since the beginning of the century, at least, has introduced many improvements on its railways; but the short distances to be run without stops do not allow its express engines to show all that they are able to do.

Italy.—The development taken by the Italian State Railway being relatively recent, the proportion of modern engines is very high. In some parts of the country the traffic is impeded by the long lengths of single main lines, which are being doubled at a great cost in the mountainous districts; but, as regards rolling stock and motive power, the railways belonging to the State leave nothing to be desired, notwithstanding that, the permanent way being still relatively light on many lines, the weight limit is not high. Italy was one of the first to electrify some of its lines, notably in the northern part of the country, which is so abundantly favoured with water-power in compensation for the total absence of coalfields. Italy has never been tardy in mechanical applications, and especially in what concerns the locomotive. Owing to the many long and heavy gradients, she was probably the first country in Europe (1883) to use ten-wheeled engines for passenger traffic; she was also among the first to adopt the bogie for several types of locomotives.

The modern locomotives actually in use on the Italian State Railways belong principally to the following types, presented approximately in the order of their introduction :—

Two-cylinder compounds (4–6–0) with 6ft. driving wheels of a total weight in working order of 62 tons.

Two-cylinder compounds (4–8–0) with a wide fire-box over the third and fourth coupled wheels; grate area, 47 square feet; driving wheels, 4ft. 7in.; total weight, 76 tons.

"Mogul" express engines, compound, two inside cylinders and outside valves and valve gears. Some of them use superheated steam; wheels, 6ft. 1in.; weight, 66·5 tons.

Very fine engines of the "Prairie" type; a first-class being four-cylinder compounds; working pressure, 227 lb.; a second-class, including a great number of engines, is composed of four-cylinder, simple-expansion, superheater steam engines; working pressure, 172 lb.—here we see the same process as with French simple engines using superheated steam: reduction of the working pressure in comparison with the compounds—grate area, 38 square feet, and a total weight of about 69 tons; same driving wheels as the "Mogul" engines.

"Pacific" engines, four-cylinders, simple expansion and superheated steam; not very numerous. (See later.) One "Mikado" type. Two types of "Consolidation" engines; one having four-cylinders, compound driving one axle; the other, two inside cylinders compound.

More recently a 2–8–2 type, more powerful, compound and superheating, has been added. It has 6ft. 1in. driving wheels. (See later.) And lastly, a "Decapod" type, simple expansion, with two cylinders.

A new type of much more powerful "Pacific" engine, with three cylinders, simple expansion, is only in contemplation for the present, I believe, and will probably be only built after reinforcement of the permanent way on main lines.

Italian railways possess also a number of tank engines, among which we must mention a "Baltic" type, of not very recent construction.

The "Prairie," "Mogul," and 2–8–2 engines are fitted with a leading bissell—type Rete Adriatica—which is in reality a bogie having wheels of different diameters, the second axle being coupled. It appears that this system has met with great favour on Italian railways, though, after trial on some French engines, it has been given up.

Numerous engines, using superheated steam, are fitted with the well-known Caprotti poppet valve gear, with very good results.

Most of these modern Italian engines are well designed and neat. It is to be regretted that the permissible axle-load is, up to the present, limited to 16 tons or—quite exceptionally, 18 tons—but this will probably be remedied at an early date for the principal main lines.

We shall now review in more detail the principal engines of the most recent types. They are well designed and worthy of interest, especially in what regards the reduction of weight, some lines being yet lightly equipped and several of these engines having to run indifferently on nearly all parts of the system. These Italian locomotives are all of very modern design, including all recent improvements, are fitted with superheaters, and are very neat. In what concerns the motion, some of them, though belonging to classes including a number of locomotives, can be considered rather as experimental in some respects, as we find both four and two-cylinder compounds, or four and two-cylinder simple expansion engines.

"*Pacific*" *Type* (Fig. 2).—Four cylinders, simple,

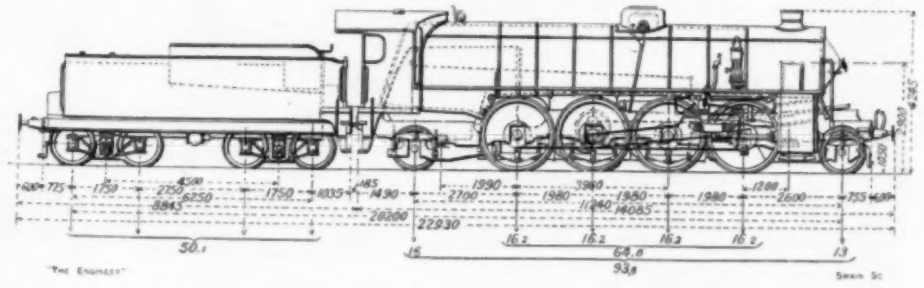


FIG. 3—ITALIAN STATE RAILWAYS—"MIKADO" TYPE LOCOMOTIVE

17¾in. by 26¾in.; diameter of driving wheels, 80in.; adhesive weight in working order, 54 tons (maximum); total weight, 87·2 tons; grate area, 38 square feet; total heating surface, 3000 square feet; working pressure, 171 lb. This is probably the lightest engine of this class recently built in Europe.

The "Mikado" Type (Fig. 3) is, properly speaking, a passenger and even an express, engine having coupled wheels of 74in. diameter; the leading coupled axle belongs to the truck—type "Rete Adriatica"—and has a lateral displacement of 1 5/16in. The trailing bissel has a displacement of 4¾in. The engine is a four-cylinder compound with corresponding cranks at 180 deg.; grate area, 46·5 square feet; heating surface, 3300 square feet; working pressure, 200 lb.; adhesive weight, 64·8 tons; total weight, 93·8 tons. Very notably more powerful than the "Pacific" type.

"*Consolidation*" *Type.*—Especially designed with the object of keeping the weight as low as possible so that it can be used on all branch lines. It has some exceptional features, being fitted with a wide fire-box spreading over the trailing coupled wheels, a very unusual arrangement for this type of engine, at least in Europe; but the boiler centre is 9ft. 6in. above the rail, the driving wheels having a diameter of 64½in. It has two inside cylinders (simple expansion) with outside valves and valve gears. Working pressure, 171 lb.; grate area, 37 square feet; total weight, 68·5 tons. As with the preceding type, the leading coupled wheels constitute the trailing truck wheels, with the same lateral displacement.

The "Decapod" Type (Fig. 4) is a simple two-cylinder engine; grate area, 46·5 square feet; total heating surface, 3000 square feet; adhesive weight, 75 tons; total weight, 84·3 tons; cylinders of 26¾in. by 26in. This engine is very light for the type, notwithstanding its large grate area.

These four types of locomotives are fitted with equalising beams and are supported on three points. The outside fire-boxes have round tops.

They are fitted with a detail, quite new, I believe, and showing a real refinement in neatness. The sand boxes for each of them are on top of the barrel, but disposed around the steam dome, which is of very small size; thus the sand is well heated and dried and the top of the barrel is not crowded with sand boxes, as on so many continental locomotives.

FIG. 2—ITALIAN STATE RAILWAYS—"PACIFIC" TYPE LOCOMOTIVE

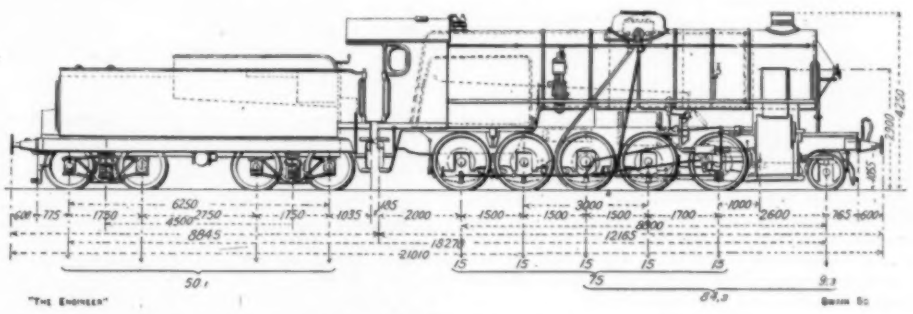


FIG. 4—ITALIAN STATE RAILWAYS—"DECAPOD" TYPE LOCOMOTIVE

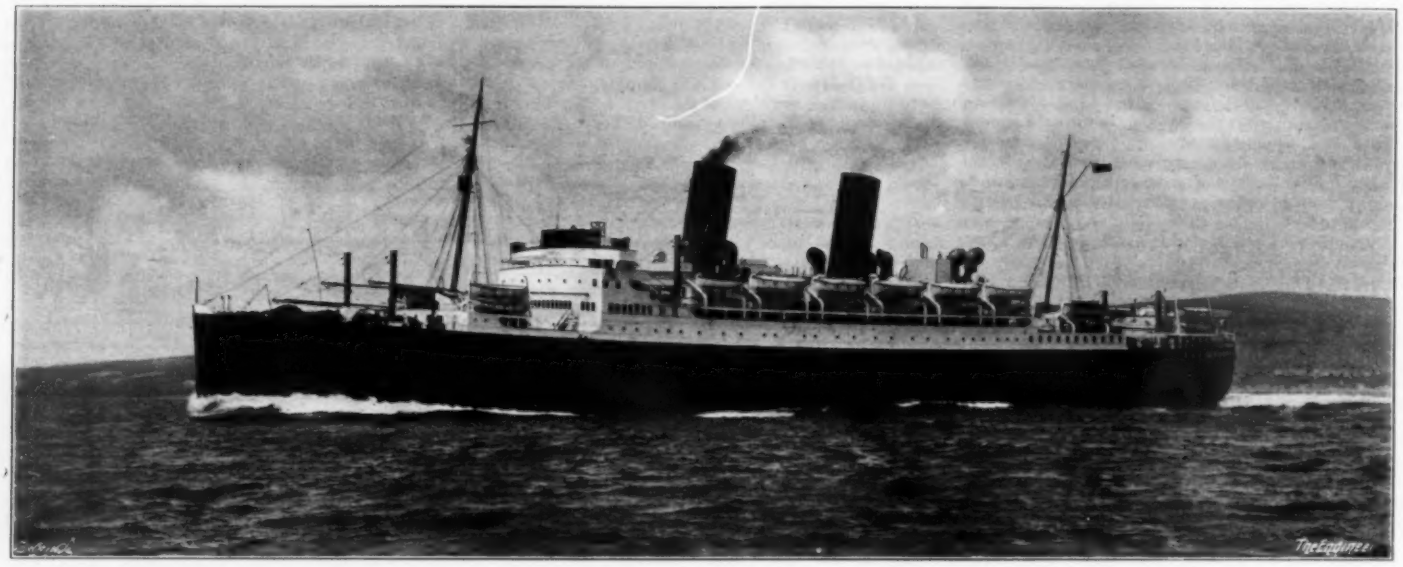
These engines are coupled to tenders of straightforward design, supported on two bogies of American pattern. The tanks have a capacity of 4800 gallons for the passenger locomotives. The maximum weight of these tenders in working order is 50 tons. The total wheel base of engines and tenders is very high, but the Italian State Railways were the first to adopt and, in some way, to make general the use of turntables of great diameter.

(To be continued.)

H

THE NEW C.P.R. LINER DUCHESS OF BEDFORD

JOHN BROWN AND COMPANY, LTD., CLYDEBANK, BUILDERS AND ENGINEERS



The New Canadian Pacific Liner Duchess of Bedford.

THE 21,500-ton twin-screw cabin steamship, the "Duchess of Bedford," which sails to-day from Liverpool on her maiden voyage to Montreal, is the first of four Clyde-built liners which the Canadian Pacific Railway Company is adding to its fleet for service on the Liverpool-St. Lawrence route to Canada and for world cruises. The machinery installation of this ship is of especial interest to marine engineers, as it comprises a twin-screw arrangement of Parsons single-reduction geared turbines working in conjunction with six Yarrow type water-tube boilers designed for a working pressure of 370 lb. per square inch with 250 deg. of superheat. In order that the water-tube boilers may only be fed with pure distilled water two 200 lb. Scotch boilers supply steam to certain auxiliary machinery and bypass some steam to the main turbines, so that the condensate is augmented and ample feed for the water-tube boilers is assured. The performance of the new ship on her trial run showed that the remarkably low fuel consumption of the company's liner the "Empress of Australia" has been improved upon, and that the new "Duchess" ships will be the most economical oil fuel turbine steamers afloat. The second vessel, the "Duchess of Atholl," has been built by William Beardmore and Co., Ltd., of Dalmuir. She will shortly run her trials and is scheduled to make her first Atlantic trip on July 13th, while the third and fourth liners, the "Duchess of Richmond" and the "Duchess of Cornwall," are in an advanced stage of construction at the Clydebank Yard of John Brown and Co., Ltd., where the "Duchess of Bedford" was built. During last week-end, on the invitation of the owners and builders, we accompanied the ship round from Glasgow to Liverpool. The builders are to be congratulated on completing this vessel in five months from the date of her launch and six weeks ahead of her contract time, thus enabling her to sail to-day.

The photograph reproduced above shows the ship taken during her recent trial run over the measured mile at Skelmorlie. She has a cruiser stern, and in company with other Atlantic ships of the C.P.R. fleet, a central stern anchor is provided as well as the two bow anchors. Her colouring is distinctive, for the hull is painted green below the water line and black above it to where the white superstructure, the promenade, bridge and boat decks begin. The funnels are buff.

DECK MACHINERY AND NAVIGATION EQUIPMENT.

All the "Duchess" class ships are built to the requirements of Lloyds 100 A1 class and to the British Board of Trade and Canadian regulations under the supervision of the consulting naval architects, C. S. Douglas and Co., of Glasgow, and Mr. H. R. Macdonald, the company's naval architect. The design of the propelling machinery was supervised by Mr. John Johnson, the owner's chief superintendent engineer. The hull has been specially designed for Atlantic service, and we found the ship to be remarkably free from machinery vibrations. All water-tight doors are operated hydraulically from the bridge on the "Brunton" system, and Welin and Welin-MacLachlan davits are provided for the boats.

The deck auxiliaries are practically all electrically driven and the equipment includes a four-ram electric-hydraulic steering gear, by Brown Bros. and Co., Ltd., of Edinburgh; electric capstans and windlasses, by Clarke, Chapman and Co., Ltd., of Gateshead; and 5-ton electric winches, by John H. Wilson and Co., Ltd., of Birkenhead. The gyroscopic compasses are by S. G. Brown and Co., Ltd., of London; and the directional wireless apparatus and band repeaters in various parts of the ship are by Marconi's. Ventilation is effected by the "Punkah Louvre" and inductor systems of the Thermotank Company, of Govan, Glasgow. Steam heating is used throughout the ship. The kitchens are electrically operated, most of the plant having been supplied by Henry Wilson and Co., Ltd., of Liverpool.

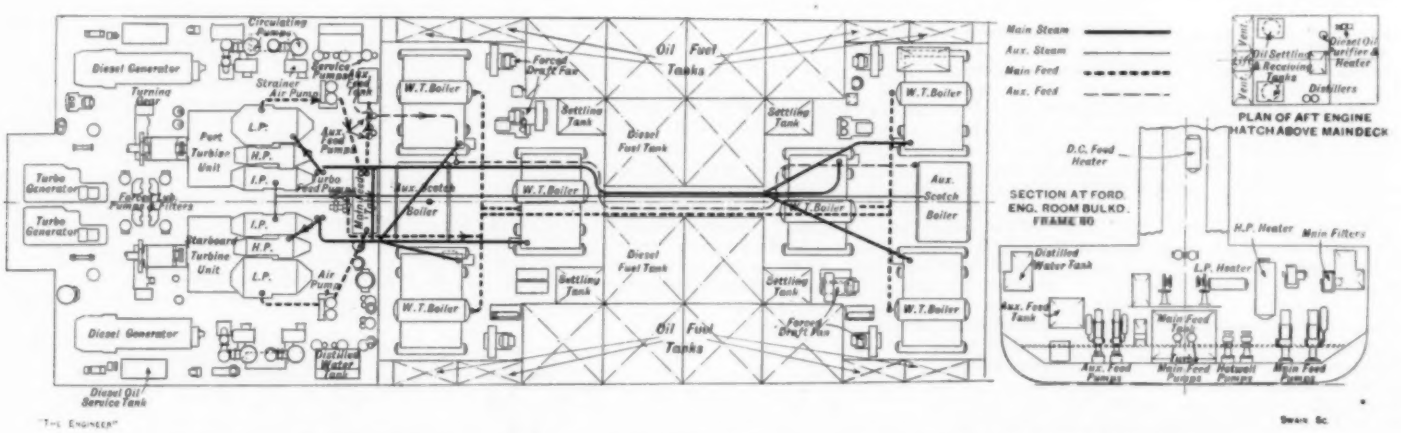


FIG. 1—BLOCK PLAN SHOWING MACHINERY ARRANGEMENT WITH DIAGRAMMATIC STEAM AND FEED CONNECTIONS

THE PROPELLING MACHINERY.

To the engineer, the geared turbine propelling installation with the patented system of combined high-pressure water-tube boilers and auxiliary Scotch boilers, which is associated with the name of Mr. J. Johnson, is of outstanding interest. We give on page 595 the principal particulars of the plant, and in the block plan, Fig. 2, its general arrangement is indicated along with the main and auxiliary steam and feed connections. These are shown in diagrammatic form only, in order to make the working of the plant still more clear. The propelling machinery and auxiliary generator sets are arranged in one engine-room. Power is transmitted by the shafts, on which Siemens-Ford torsionmeters are fitted, to outward turning propellers supplied by the Manganese Bronze and Brass Co., Ltd. The propellers each have four blades of aerofoil section and their diameter is 18ft. 9in., with a pitch of 17ft. 6in. The main turbines are of the latest Parsons three-stage type and were constructed by the builders under licence. There is a centre high-pressure turbine with an inner intermediate-pressure turbine and an outer low-pressure turbine for each unit. Each turbine drives a separate pinion which meshes with the common 14ft. diameter main gear wheel on the propeller shaft. The astern turbines are incorporated in the casings of the intermediate and low-pressure ahead turbines and the astern power is about 65 per cent. of the full ahead power of 20,000 S.H.P. Fig. 2 is a view looking forward at the gangway between the two intermediate pressure turbines which leads to the control station. The heavy insulation of all steam pipe connections may be pointed out. The result is a comparatively cool engine-room even above the turbines.

The main condensers are underslung beneath the low-pressure turbine flanges and they are of the Weir regenerative type. Each condenser has a surface of 10,600 square feet and some 5000 cupro-nickel tubes are fitted. Weir air pumps are employed and the designed vacuum is 29in. with a sea temperature of 60 deg. Fah. The main circulating pumps, like most of the other auxiliary pumps, are electrically driven, and we noted that many of them were of the Drysdale "Centrex" type. Most of the motors in the engine-room were of the Laurence Scott type, but we noted motors by W. H. Allen, Sons and Co., Ltd., and Veritys, Ltd., in other parts of the ship.

Two 500-kW British Thomson-Houston geared turbine generator sets are placed between the propeller shafts at the after end of the engine-room, and above them is the main switchboard and gallery. The switchboard was built by Messrs. Whipp and Bourne. In the outer wings of the engine-room aft are arranged two Allen-B. and W. 450-kW six-cylinder generator sets with their auxiliaries. Fig. 3 is a view looking aft in the engine-room and upper part of the electrically operated turning gear for the main turbines is visible with one of the turbo-generators. The view also shows the lift from the engine-room to the engineers' quarters on a top deck. At the forward end of the engine-room, as indicated to the right of Fig. 2, the main and auxiliary feed tanks with their pumps are fitted. The main feed pumps were supplied by Weir and are of the turbine-driven type, with reciprocating stand-by and auxiliary pumps by the same makers. Our drawing shows the lay-out of the boiler rooms, each of which contains three water-tube and one Scotch auxiliary boiler. We have given some particulars of the water-tube boilers in the table on page 595. They were designed by Yarrow and Co., Ltd., of Scotstoun, and were built to drawings prepared by that firm by John Brown and Co., Ltd. Each boiler has six furnaces, to which Howden-Wallsend oil-burning equipment designed to work on the open stokehold system is fitted. Fig. 4 shows one of the Yarrow boiler fronts with

the oil burners and a water gauge of the "Pneumacator" type which has been supplied by Kelvin, Bottomley and Baird, Ltd., of Glasgow. The main water gauges are, of course, high up on the water drums, and the builders have designed a convenient arrangement of mirrors which enables them to be read; the "Pneumacator" gauge, however, is in full sight of the attendant. Each water-tube boiler is provided with its own motor-driven fan. Other auxiliary appliances which we saw in the boiler

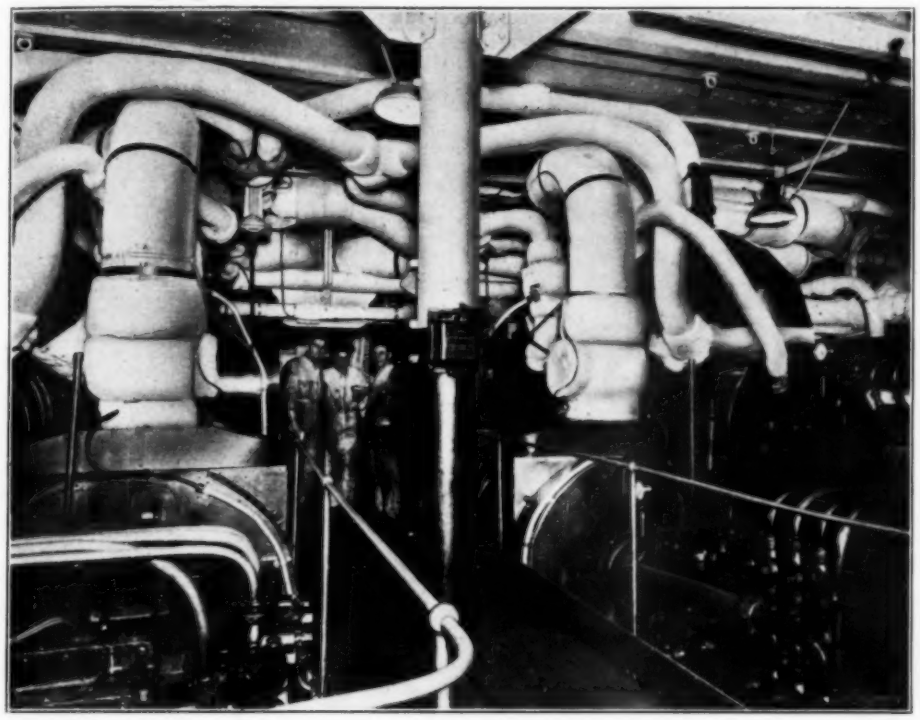


FIG. 2—MAIN TURBINES LOOKING FORWARD

room included a Duplex-Mono gas analysing machine for automatically recording the CO and CO_2 contents of the flue gases, which was supplied by James Gordon and Co., Ltd., of Kingsway, London. The same firm has fitted the Armstrong system of high and low-water alarms and distant indicator. This appliance consists essentially of two horizontally arranged expansion tubes connected to the steam and water spaces and mounted outside the drum. The top tube is full of steam and the bottom one full of

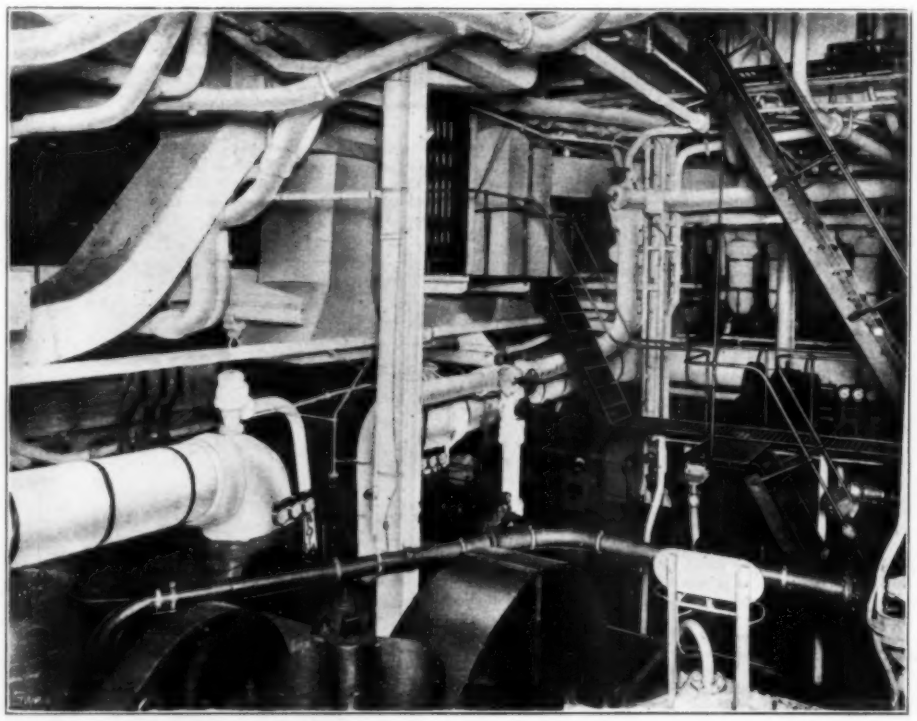


FIG. 3—VIEW IN AFTER PART OF ENGINE ROOM

water, and if any change in level takes place the water rises so as to fill the top tube; it contracts and operating a lever closes a switch which completes a circuit, blows a Klaxon horn, and illuminates a "high" sign on the indicator. The horn continues to sound until the tube again becomes full of steam. In a similar way the "low" sign is illuminated and the horn blown when steam enters the lower expansion tube. Each of the boilers is fitted with a Mumford's feed regulator, which, we understand, controls the feed within fine limits. Smoke indicators have been supplied by the builders and Foster type electric pyrometers are fitted, so that a very close control of boiler operation can be maintained. Each of the Scotch auxiliary boilers has a diameter of 16ft., with a length of 11ft. and is fitted with three furnaces. The saturated steam for certain auxiliaries, for heating and for the make-up feed—supplied through a connection to the intermediate-pressure turbine—is generated at 200 lb. pressure. In actual operation one boiler has been found to be fully sufficient to meet the demands for steam. The raw feed is supplied to the Scotch boilers only. In the corridor between the two boiler rooms are grouped the "Pneumacator" indicators for the oil tanks.

The coolness of the boiler rooms was commented upon by those who visited them. Here again effective insulation undoubtedly plays an important part. The water drums are heavily wrapped in insulation, which is then enclosed in a galvanised iron casing that was cold to the hand. Even at the back of the boilers the hand could be placed with comfort on the outer wall adjoining the working gangway. Above the boiler the temperature was between 80 deg. and 90 deg. Fah.

The overall thermal efficiency of the installation is, we understand, a very high one. The combustion air is preheated to 320 deg. Fah. before entering the furnaces, and the feed is delivered to the water-tube boilers at a temperature above 300 deg. Fah. It is heated on the suction side of the pumps by a direct contact heater placed in the engine-room hatch, while on the discharge side it passes through heaters fed with bled steam.

Other plant to which we may refer includes the CO_2 refrigerating equipment, which is placed aft between the tunnels. It is electrically driven and was supplied by J. and E. Hall, Ltd., of Dartford.

TRIAL RESULTS AND OPERATING CONDITIONS.

The speed and consumption trials made on the Clyde at Skelmorlie were, we understand, eminently satisfactory. The guaranteed fuel consumption of 0·70 lb. of oil fuel per S.H.P. hour for all purposes was obtained, with a substantial margin to the good, and the same applies to the speed of the ship. No trouble of any kind was experienced, we learned, with the high-pressure boilers, steam pipes and fittings, and both during the trials and when we were on the ship the main and auxiliary machinery worked without a hitch.

The owners do not intend to publish a fuel rate until actual service results are available, but it must be of considerable satisfaction to them to know that they possess a vessel which will do even better than their "Empress of Australia," the average consumption figure for which

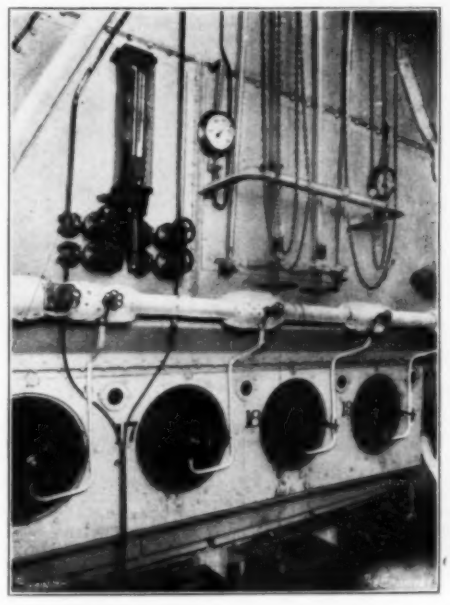


FIG. 4—A WATER-TUBE BOILER FRONT

works out at about 0·73 lb. per S.H.P. for all purposes. The experience with the combined system of water-tube and Scotch boilers, which enables the high-pressure boilers to be fed with distilled water only, with which the "Beaver" class of C.P.R. cargo ships are fitted, as well as the "Duchess" liners, shows that the system is one which excludes dirt and lubricating oil from the main boilers, the internal surfaces of which may be coated with a graphite preservative compound which tends to improve heat transmission and is a protection against corrosion. This being so, the boilers are clean in operation and the upkeep expenses of the boilers should be correspondingly reduced. It is interesting to note that in the "Duchess of Bedford" a 20,000 S.H.P. turbine installation has been got into the same space as that occupied by a 12,000 S.H.P. installation in a sister liner the "Montcalm." The lighter and more efficient installation marks an important advance and the service performance of the "Duchess" liners will be awaited with unusual interest by marine engineers, both in this country and abroad.

The leading particulars of the vessel are given below:

Hull Particulars.

Length overall	600ft.
Breadth moulded	75ft.
Depth to bridge deck	53ft.
Loaded draught	27ft.
Gross tonnage	21,500
Service speed	17½ knots
Designed capacity of fuel tanks	2725 tons

Passenger Accommodation.

	Number of persons.
Cabin class	600
Tourist third class	500
Third class	500
Crew and staff	409
Total ship's complement	2009

Turbine and Boiler Particulars.

Type of propelling machinery	Twin-screw single-reduction geared turbine

Main Turbines.

Designed output	20,000 S.H.P.
Turbine revolutions	2000 r.p.m.
Propeller revolutions	120 r.p.m.
Pressure at stop valve	350 lb. per sq. in.
Degree of superheat	250 deg. Fah.

Boiler Installation.

Number of Yarrow water-tube boilers	Six
Designed working pressure	370 lb. per sq. in.
Total steam temperature	680 deg. Fah.
Total generating surface, six boilers	30,700 sq. ft.
Superheater surface, six boilers	12,500 sq. ft.
Air heater surface, six boilers	30,000 sq. ft.
Number of Scotch auxiliary boilers	Two
Heating surface each boiler	3000 sq. ft.

Auxiliary Generating Plant.

Two B.T.H. turbo-generator sets	Each 500 kW
Two Allen-B. and W. oil engine-driven sets	Each 450 kW
One boat deck emergency Gardner oil-electric set	75 kW

Automatic Control Gear for Gas-works, Boiler Plant, Etc.

By the courtesy of Mr. Smith, B.Sc., engineer and manager of the Bolton gas department, we were recently afforded the opportunity of inspecting the Reavell-Askania regulators which control the withdrawal of gas from the retorts are obtained with practically level gauge pressure at the gas offtake. Furthermore, it is of the greatest importance that the pressure should be maintained constant with the least possible variation. For this purpose a regulator of the hydraulic relay type provides the necessary sensitiveness and accuracy, and at the same time develops the power required to move heavy valves which operate in tarry gas. After previous satisfactory experience with this type on other installations of vertical

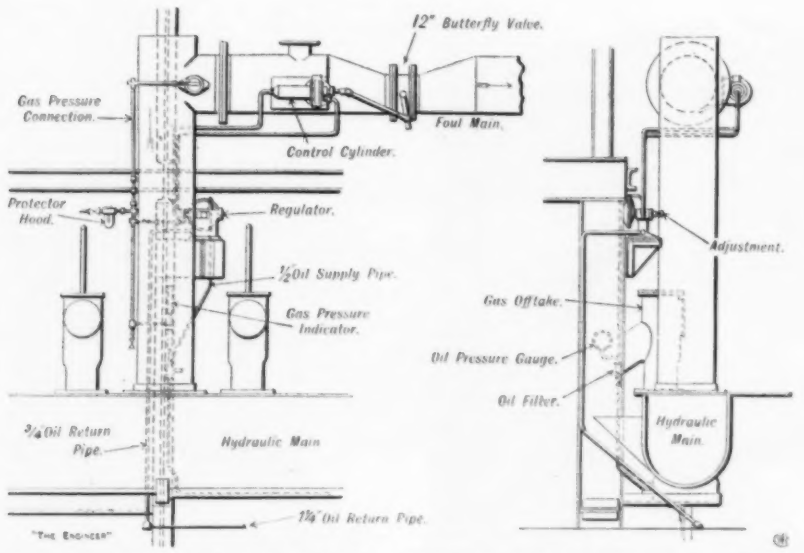


FIG. 1—LAY-OUT OF REAVELL-ASKANIA REGULATOR, ETC., AT BOLTON GAS WORKS

new installation of Woodall Duckham continuous vertical retorts at Bolton gasworks.

The retorts, which are twenty-four in number, are each capable of carbonising 8 tons of coal per twenty-four hours, and are arranged in four groups of six retorts. The total output of the bench, which is the third installation of W-D continuous vertical retorts at Bolton, is approximately 3½ million cubic feet per twenty-four hours. Each retort is about 25ft. in length and of rectangular section, tapering to permit continuous free movement of the charge down it. The producers which furnish the gas for heating

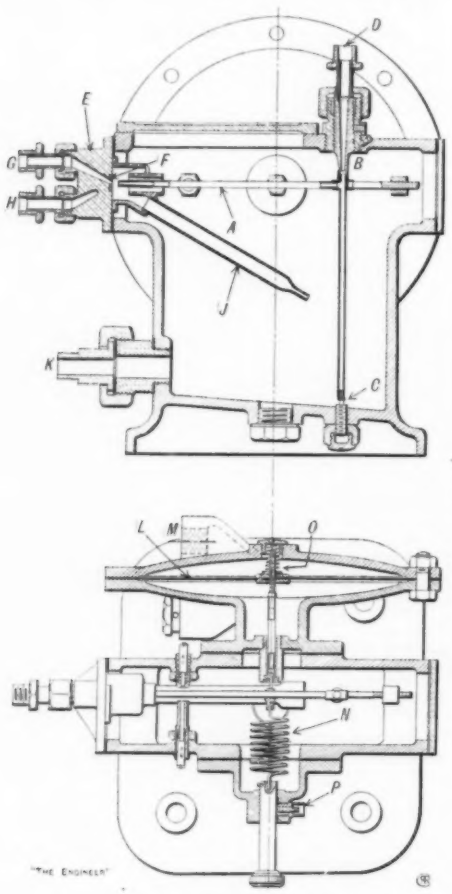


FIG. 2—SECTIONS THROUGH REGULATOR

the retorts are built on to the side, the gas entering a large manifold, from which it passes into the heating flues at the top of each retort, the direction of combustion being downwards. The flue gases leaving the setting pass, *viâ* a waste-heat manifold, to a waste heat boiler, and thence to the chimney. In accordance with Messrs. Woodall Duckham's usual practice, steam is admitted to the bottom of the retorts, forming water gas by reaction with the coke. This renders the plant very flexible, and results in a very high yield of therms per ton of coal carbonised.

The Woodall Duckham companies have found that the most favourable working conditions for continuous vertical retorts, Messrs. Woodall Duckham decided to employ at Bolton the Reavell-Askania regulator, which is manufactured by Reavell and Co., Ltd., of Ipswich, who have acquired the British Empire licence. This regulator was exhibited at the British Industries Fair, and a description of it appeared in our special Fair Supplement of February 17th. The characteristic feature of the device is a swinging oil jet relay, which controls the distribution of oil under pressure to the control cylinder operating the regulating valve.

In the case of the Bolton plant, the relay is controlled by a leather diaphragm, which is subjected to the gas pressure, fluctuations of the latter causing the relay to respond, so that oil flows to the control cylinder, moving the valve to restore the pressure to its correct value. Fig. 1 shows the lay-out of the regulator, control cylinder and valve for one group of six retorts. The horizontal mains from each group of retorts are led into one common foul main after regulation of pressure. This common main conducts the gas to the exhauster house.

The regulator is shown in section in Fig. 2. The swinging jet or "jet pipe" A is arranged to move in a horizontal plane pivoting on the tapered oil inlet B and the pin point C. Oil enters at a pressure of 50 lb. to 70 lb. per square inch through the connection D, and passes along the horizontal limb of the jet pipe A to the small nozzle at the tip. This nozzle has a hard steel liner to prevent erosion and is $^1/_{16}$in. diameter. The free oil jet from the nozzle impinges on the distributor E, on the face of which is a hard steel inset F, which has two small adjacent orifices, one behind the other, also $^1/_{16}$in. diameter. When the jet pipe is in mid-position, the oil strikes between the two orifices and its velocity head is reconverted into static pressure. The pressure is the same at both orifices and therefore at the screwed connections G and H, to which the oil connecting pipes to the control cylinder are attached. Should, however, the jet pipe be deflected, either to the right or left, the pressure will rise at one orifice and fall at the other, so that there is a difference of pressure across the piston in the control cylinder. The piston will therefore be set in motion at a speed depending chiefly on the rate at which the oil is supplied through the jet pipe.

It will be appreciated that the oil striking the distributor only passes to the control cylinder when the jet pipe is deflected from mid-position, and even when a certain quantity enters one of the orifices an equal amount is returned through the other. There is accordingly a constant flow of oil through the drain connection K. The special return pipe J is fitted to prevent splashing and foaming of the oil, and also to ensure that air cannot enter the orifices and be driven into the cylinder.

The jet pipe is controlled by the soft leather diaphragm L, which is connected to the jet pipe through a rod working in a gland.

For retort house governors of the type installed at Bolton, it is desirable that the regulator should be adjustable for a pressure range between a given positive and a given negative value. The gas pressure connection M is therefore made on the outside of the diaphragm housing, so that an increase in absolute pressure tends to move the diaphragm inwards. The force due to the diaphragm is balanced by that of the spring N, which is adjustable by means of the plunger. A counter spring O is fitted outside the diaphragm, the strength being so chosen that the jet pipe is in mid-position when the gas pressure is zero, and the plunger is half-way in. With this setting the regulator will maintain zero or level gauge pressure. If, for example, the pressure become positive owing to an increased make of gas, the greater force on the diaphragm causes the jet pipe to move to the left. Oil then flows through the left-hand connection H, so that the control cylinder opens the butterfly valve enabling the exhauster to draw the gas away.

If it should be desired to maintain positive pressure the adjustment plunger is pushed further in so that the increased force of the spring N balances the pressure on the diaphragm. If the adjustment plunger is pulled out from the centre position, the regulator will maintain suction instead of pressure, since the force of the counter spring is now greater than that of the spring N, and the regulator will open the butterfly valve until there is sufficient suction on the diaphragm to bring the jet pipe to mid-position.

The regulators at Bolton are adjustable between plus $^6/_{10}$in. W.G. and minus $^6/_{10}$in. W.G., and will maintain constant any pressure within these limits with a maximum permanent variation of about $^1/_{100}$in. W.G. The plunger is locked in position by the screw P.

This high degree of accuracy is due primarily to the construction of the relay. It will be appreciated that since the jet pipe is pivoted on the pin C and the taper oil inlet B where the bearing surfaces are force-lubricated by the small oil leakage at this point, the system is practically frictionless, and responds to the slightest pressure variation, and as the maximum travel of the jet pipe nozzle is $^1/_{16}$in., the inertia effect is infinitesimal, and hunting is entirely prevented.

Fig. 3 shows a sectional arrangement of the control cylinder, which operates a 12in. bore butterfly valve. The design is quite straightforward, the diameter being 3½in. and the stroke 8in., but the lay-out of the connecting link and the valve lever should be noted. The valve is closed when the piston is in the extreme left-hand position—Fig. 3—while the valve lever and connecting link are approximately at right angles to one another. When the valve is open and the piston-rod fully extended, the lever and connecting link are more nearly in line with one another. With this arrangement the ratio of valve to piston movement decreases progressively as the closed position is approached, which ensures that the sensitiveness and accuracy of control are the same over the whole range and eliminate the possibility of over-regulation when the valve is nearly closed.

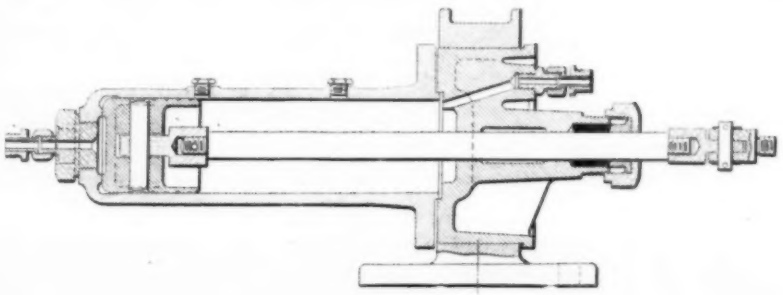


FIG. 3—LONGITUDINAL SECTION THROUGH CONTROL CYLINDER

The oil supply is provided by two direct-acting boiler feed type steam pumps, installed in duplicate—one as stand-by—on steel work at one end of the retort house,

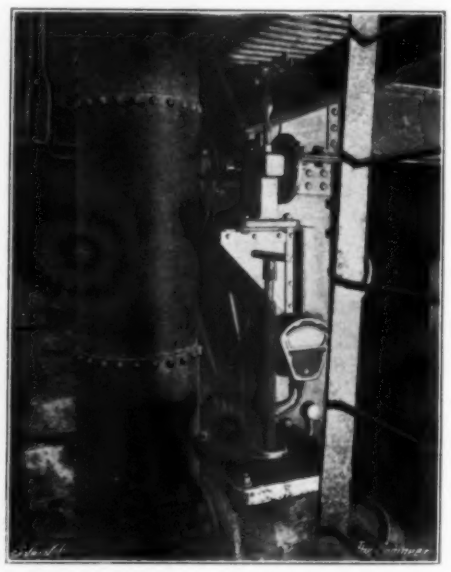


FIG. 4—GENERAL VIEW OF REGULATOR

The oil is drawn from an air-tight tank mounted beside the pumps, and is delivered to the regulators by two pipes running along either side of the retort bench, a pressure gauge and filter being installed before each regulator.

The oil draining from the regulators is carried by ¾in.

piping to either of two 1¼in. return pipes, which lead the oil back to the tank, where a fine mesh filter is fitted to intercept any foreign matter. The pump plant is installed at a level about 13ft. below that of the regulators to ensure that the oil returns freely.

To prevent injury to the regulator and pressure recorder, a special device known as a "Protector Hood" is installed. This device, which is shown to the left in Fig. 1, consists of a liquid seal which functions as a non-return valve, and allows clean gas to pass into the gas pressure connection at such a rate that it just diffuses slowly into the gas

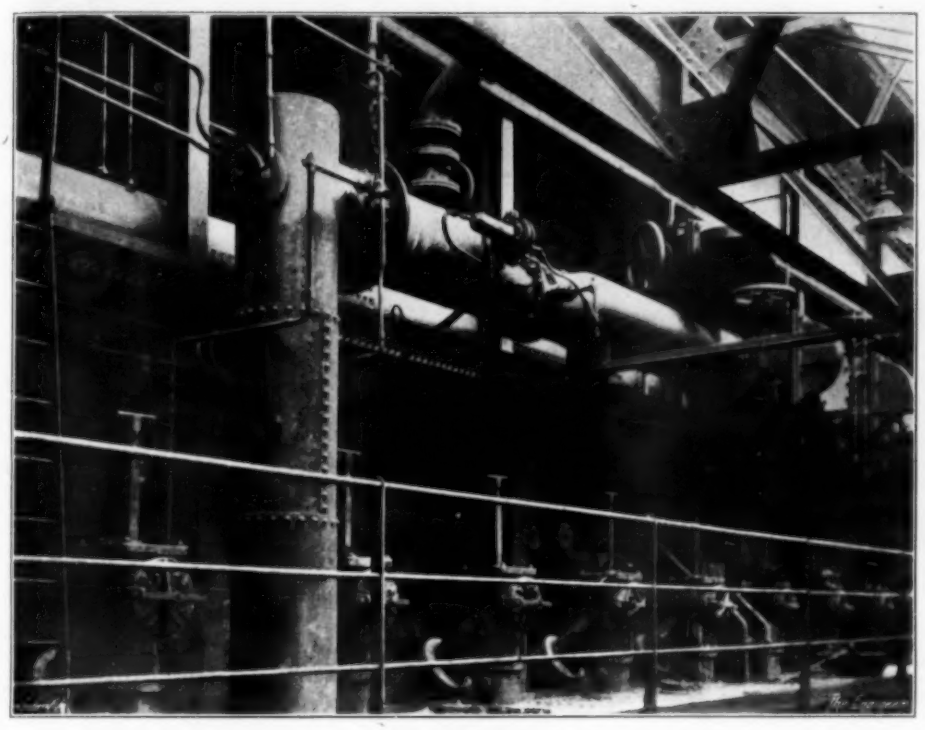


FIG. 5—VIEW SHOWING CONTROL CYLINDER AND BUTTERFLY VALVE

main, forming in the pipe a gas "buffer" which, while transmitting the pressure, completely prevents the entry of foul gas into the regulator and pressure gauge. The consumption of gas for this purpose is approximately 1 to 2 cubic feet per hour.

Fig. 5 shows the arrangement of the horizontal foul main from one group of retorts, the off-takes of which are visible in the lower half of the engraving. The vertical main in the foreground takes the gas from the horizontal collecting main into the foul main above, mounted upon which the control cylinder may be seen, with the butterfly valve to the right. The regulator is not visible in this view, being hidden behind the vertical main.

Fig. 4 shows a general view of the regulator and foul main with the control cylinder and valve. The gas pressure indicator and the oil pressure gauge may be seen

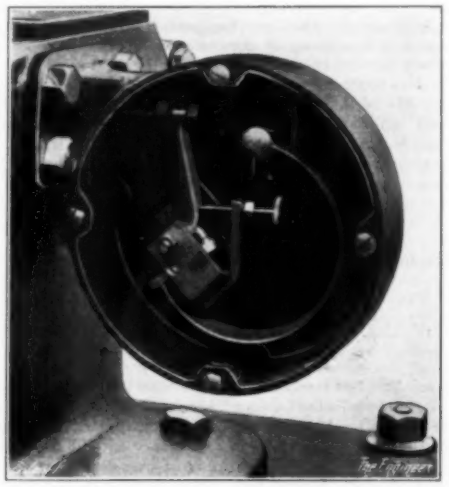


FIG. 6—BOURDON TUBE

mounted on the steel work to the right of the regulator, while the connections through which the foul gas from the retorts enters the hydraulic main are visible in the foreground.

The accuracy with which the regulators will, when suitably adjusted, maintain level gauge pressure at the top of the retorts, may be judged by removing one of the plugs from the mouthpiece at the top of the retort, when it will be seen that while no gas, which is visible on account of the tar present, is expelled from the retort, neither is air drawn in, the gas just hovering in the plug orifice.

Plants of this type with steam-driven pumps will also be installed in conjunction with the new installations of vertical retorts Messrs. Woodall Duckham are erecting at Saltley (Birmingham), Dawsholm (Glasgow), and Smethwick (Birmingham). An otherwise identical plant to be installed at Fulham will have duplicate pumps belt driven by electric motors.

Another interesting application of the system to gasworks is to the control of the exhausters. The usual practice in this country is to regulate the exhauster so that constant draw is obtained at the inlet of the machine. The Reavell-Askania regulator may be arranged to do this by controlling the exhauster speed, the control cylinder operating the engine or turbine governing gear, or alternatively the control cylinder may operate a by-pass valve which allows sufficient gas to be passed back to the inlet to maintain the suction conditions constant. The latter method has the advantage that the regulation is more accurate than with speed control, which has the drawback that the engine or turbine does not respond sufficiently to the regulator on account of the inertia of the moving parts. Speed control, on the other hand, is, of course more economical as regards power consumption. The two methods may, however, be combined if desired, the regulator operating primarily on a by-pass valve which responds at once to any change in the pressure, and is normally nearly closed, passing only a small fraction of the total volume. Attached to the by-pass control cylinder is an oil distributing valve which controls the supply of oil to a second cylinder operating the speed governing gear. Any fluctuation of pressure therefore results first in a movement of the by-pass valve, with a subsequent correction of the speed of the plant. When the pressure is again normal, the by-pass and its cylinder will have returned to their original positions and the distributing valve be again closed. The cylinder controlling the speed accordingly remains in its new position, until a further change occurs.

It is therefore clear that all permanent fluctuations are ultimately dealt with by speed control, and since the by-pass is nearly shut in its normal position, the economy obtained with this system is practically equal to that due to speed control only, but the regulation is far more accurate. This system is particularly suitable for the control of town's gas and coke oven plants where the control of the withdrawal of the gas is carried out only at the exhauster.

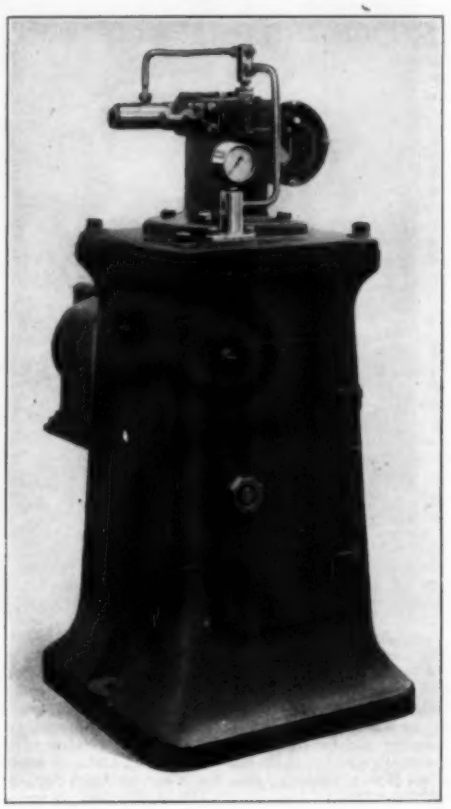


FIG. 7—REGULATOR FOR GRAIN ELEVATOR

Other typical applications of the standard low-pressure Reavell-Askania regulator with the leather diaphragm impulse system are to the control of gas producers, chimney draught and to the distribution of town, coke oven, producer gas, &c. For the control of higher pressures the leather diaphragm shown in Fig. 2 is replaced by the Bourdon or "spring" tube shown in Fig. 6. The motion of the free end of the tube is transmitted to the jet pipe by means of a bell crank lever and push rod so that any variation of pressure causes the jet pipe to move, oil flowing to the control cylinder, which alters the setting of the control valve and effects the necessary pressure correction. This system is applicable to all high-pressure or vacuum controls, such as the distribution of steam for

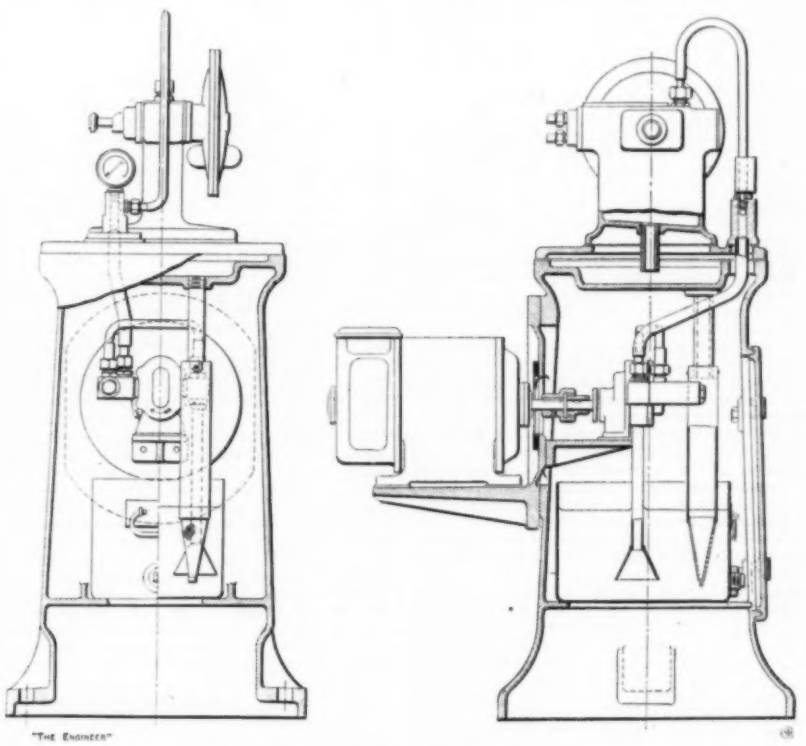


FIG. 8—REGULATOR WITH OIL PUMP

ASKANIA REGULATOR CONTROLLING STEAM BOILER FURNACES

FIG. 9

FIG. 10

FIG. 11

process work, &c., the control of extraction steam engines and turbines, turbo and reciprocating compressor and exhauster plants, &c. Fig. 7 shows a regulator of this type which is one of three Reavell and Co., Ltd., are supplying to Henry Simon, Ltd., for their contract for grain elevating plant at Avonmouth Docks, Bristol.

The three Reavell turbo-exhausters are driven at constant speed by three-phase motors and operate at constant volume. Since a turbo-exhauster has a falling vacuum-volume characteristic it follows that an increase in volume, owing to the withdrawal of the nozzles from the grain, results in a fall of vacuum, while the power consumption rises considerably. The regulators are arranged to prevent this overloading by maintaining constant vacuum at the exhauster inlet so that the quantity of air and the power consumption are both constant.

The control cylinder operates a butterfly valve and the vacuum connection to the regulator is made between the valve and the machine. Should the volume increase owing to the withdrawal of a nozzle from the grain, the regulator closes the valve until the vacuum and volume are again normal. The normal vacuum is 11in. Hg., but provision is made to vary it, and hence vary the volume dealt with as desired.

To obtain the rapid operation required to cope with the sudden overloads met with in a plant of this type the regulator is provided with a special auxiliary oil distributing valve which replaces the normal distributor. This valve is controlled by a small piston which is in turn operated by the jet pipe, the valve ports being so designed that a considerably greater quantity of oil may be supplied to the cylinder than would otherwise be possible. This valve is also fitted when the larger sizes of control cylinder are used and when exceptionally high operating forces are required. The regulator—shown in Fig. 7—is mounted on a cast iron pedestal. This constitutes Reavell and Co.'s standard construction for the oil pumping plant, and is shown in section in Fig. 8.

The pump is of the high-speed gear type and is direct-coupled to an electric motor mounted on a bracket attached to the side of the pedestal. An adjustable spring loaded by-pass valve is fitted to the delivery of the pump, so that the oil pressure may be set at any desired value.

When required up to four regulators may be mounted on one pedestal. The regulators are attached to a cored platform, which is built on the top of the pedestal. The oil returns through this platform, and is delivered into the recess cast on the top of the pedestal, afterwards flowing into the tank through a fine mesh filter, which is easily removed for cleaning. The oil from the pump is delivered to the regulators through a distributor fitting, on the top of which is mounted a pressure gauge.

A noteworthy feature of the Reavell-Askania system is the standardisation which has been effected for the various components. The jet pipe housing, for example, is common to all types of regulators with one exception, and two or more impulse systems of various types suited to the particular application may be attached to this casing as required. For mixing two gases, for instance, two leather diaphragm type impulse systems are fitted, one on each side of the jet pipe housing, the adjustment system being a modification of that employed on a simple pressure regulator.

The exception referred to above is the temperature regulator. The thermostat used in conjunction with this device consists of a metal tube enclosing a steel wire. Changes of temperature result in a differential expansion, which is transmitted to the jet pipe by suitable link-work. Since the thermostat has obviously to be mounted on the plant in which the temperature is to be controlled, the jet pipe housing is of such a form that it may be attached to the end of the thermostat.

In addition to the purposes which we have mentioned, the apparatus which constitutes the essential feature of the Reavell-Askania system is equally applicable to the completely automatic control of boiler furnaces. Variations in the steam pressure, draught or fuel supply may be made to influence, either directly or indirectly, the diaphragms of controllers, and so to bring about the adjustments necessary to maintain combustion under the desired conditions. The development of boiler control apparatus on these lines has already made headway in Germany, an interesting example being illustrated in Figs. 9, 10, and 11 above. This particular plant has been working for some time in the Moabit power station at Berlin, controlling the combustion for the pulverised fuel boilers there. The installation was designed by the Allgemeine Electricitäts Gesellschaft, in collaboration with the Askania company. It embodies the principle of regulating the furnace conditions in accordance with the CO_2 content of the flue gases. For this purpose the well-known Ranarex CO_2 indicator of the A.E.G. company is employed as a kind of master controller. The instrument—shown in Fig. 9—by reason of its mechanical nature, is very powerful, amply powerful in fact for the pointer to operate the swinging jet pipe of the Askania regulator attached to the case of the indicator. The control cylinder actuated by the CO_2 instrument is mounted on the stand shown in Fig. 10, this stand being at the side of the boiler, and the Ranarex recorder behind the latter. The essential function of the apparatus on the stand is to control the boiler damper. The oil cylinder which actually does the work can be seen affixed to the boiler stanchion with the damper rod running vertically up from it. The swinging jet which actuates the control piston is acted on by two diaphragms working against each other. One diaphragm is deflected by the suction pressure produced by a very small fan belted to the pulverised coal feeder, as shown in Fig. 11. Obviously, the more coal delivered to the furnace, the greater the suction of this little fan, and the greater the tendency to deflect the jet and to open the damper. This tendency is opposed by the other diaphragm, which is actuated by the pressure drop across the boiler itself, and therefore by the rate of combustion. This second diaphragm does not act directly on the jet-pipe, but on a swinging lever, the pressure being transmitted to the jet pipe by a movable distance piece, the position of which is determined by the control cylinder of the Ranarex instrument. A fall in the CO_2 percentage diminishes the virtual leverage of the second diaphragm on the jet and so tends towards the closing of the damper. The effect of the whole combination, which is composed of extremely simple and robust elements, is to give a practically instantaneous response of the damper to changes in the rate of combustion, and to maintain the CO_2 at its maximum desirable value under all conditions of load and fuel, without any attention whatever on the part of the fireman. By the courtesy of the A.E.G. company, we have been enabled to watch the operation of the apparatus at Moabit, and formed a very favourable opinion of its practicability and adequacy for its duties.

EXPORTS of machinery in April amounted to 44,062 tons, valued at £4,143,000, compared with 51,085 tons, valued at £4,813,000 in March, and 36,522 tons, valued at £3,598,000 in April, 1927. Exports of motor cars and chassis in April numbered 2444, compared with 2490 in March and 3534 in April, 1927. The value of motor cars and parts and accessories thereof exported in April was £621,000, compared with £652,000 in March and £799,000 in April, 1927. The number of motor cars and chassis imported in April was 3354, compared with 2556 in March and 3403 in April, 1927. Compared with April, 1927, there was a large increase in the export of new ships and boats and of locomotives.

Letters to the Editor.

(We do not hold ourselves responsible for the opinions of our correspondents.)

OXYGEN JET CUTTING.

SIR,—We notice in your issue of March 23rd a short paragraph relating to oxygen jet cutting.

We should like to point out that we have investigated the effects of oxygen cutting on steel plate and forgings at various intervals during the last five years, and are, in fact, at the present moment engaged on further extensive investigations to determine every phase of the effect of oxygen cutting.

Our experience has always been that with a good cut produced by a properly designed mechanically driven cutting machine, the maximum depth of the effect of an oxy-acetylene or oxy-coal gas cut does not exceed $\frac{1}{16}$in. In fact, for many purposes it may be assumed that the effect of the cutting at a greater depth than $^1/_{32}$in. can be ignored.

One of the things which troubles the minds of engineers who have not tried this cutting process appears to be the question of hardening of the cut surface. We have conclusively proved that on average quality mild steel plate, such as is generally used for engineering production work, absolutely no hardening of the surface takes place, the Brinell hardness figure only being increased by about 45 points. A tensile test on a strip of gas-cut material shows an actual increase in tensile strength owing obviously to this slight toughening of the cut layers.

For THE BRITISH OXYGEN Co., Ltd.,
C. G. BAINBRIDGE,
Department Manager.

London, N. 18, May 23rd.

THE USE OF WIRE ROPE IN STRUCTURAL FRAMEWORKS.

SIR,—The test results on 120 cwt. and 135 cwt. given in my letter are selected from numerous tests on actual cables used in R 101; 135 cwt. is the largest cable used in that structure, and it seems hardly necessary to add that the properties of the 40ft. cables are in no way dissimilar from those of the 8ft. referred to.

The loose quasi-technical wording of "Hexagon's" letters makes it difficult to discuss the many other fallacies contained in his observations. For example, it now appears that the first forty odd lines of his letter of April 24th were merely intended to indicate that the shear wires should not become plastically deformed or stretched under maximum flight loads. If this be so, the value of Young's Modulus is irrelevant. In any case, the experimental results on the "R 101" wires disprove "Hexagon's" statements.

The value of E in Colonel Richmond's hypothetical wire would be about 9500 tons per square inch per inch for 100 tons per square inch breaking stress. As your correspondent gives values of 2500–3500, there appears to be something wrong about this calculation business also.

JAMES D. NORTH.

Norwich, May 24th.

Railway Matters.

THE Returns of Accidents and Casualties on British railways during last year have now been issued as a Stationery Office publication, price 1s.

THE reconstructed station at Wimbledon is beginning to show what it ultimately will be like. The four original main lines through the station are now in their permanent position; the roofing of Nos. 5–6 platform is practically completed, that on Nos. 7–8 platform is nearly finished, and Nos. 3–4 platform roofing has been begun. The Mitcham branch lines are now being dealt with.

IT was only as recently as in our issue of March 9th that we referred to a letter in *The Times* from Mr. A. Rosling Bennett, one of the many historians of the locomotive, as to his having, at the British Association meeting in 1891, proposed the construction, equipment and operation of a tube railway similar to what is now known as the Post Office tube. We regret that we have now to record Mr. Bennett's death on May 24th.

THREE officers in the Signal and Telegraph Department of the Great Western Railway have been given higher rank as a consequence of the promotion of Mr. C. M. Jacobs to succeed the late Mr. R. J. Insell, as signal and telegraph engineer. Mr. S. Hutt, hitherto known as assistant to signal engineer, becomes assistant signal engineer; Mr. H. F. D. Page, divisional signal engineer at Cardiff, is made assistant to signal engineer; and Mr. G. H. Crook, one of Mr. Insell's assistants, is also given the latter title.

THE Ministry of Transport railway statistics for February, obtainable from the Stationery Office, price 3s. 6d., show that, compared with February, 1927, there was an increase of 8·3 per cent. in the number of passenger journeys—owing, we assume, to this being leap year—and of 6·1 per cent. in the receipts from passengers and of 7·4 per cent. in the passenger train mileage. The tonnage of freight was, however, down by 6·0 per cent.; the ton-miles by 7·1 per cent., and the freight train receipts by 3·9 per cent.

DURING the three months ended September 30th last, the assistant inspecting officers of the Ministry of Transport held fifty-five inquiries into the more serious accidents to railway servants, of which twenty were fatal cases. Of the men killed, nine were permanent way men, two were signal fitters and two were porters. In nine cases the cause assigned was want of care on the part of the deceased; in four, it was want of care on the part of a fellow-servant; in six it was misadventure; and in one an error of judgment by a fellow-servant.

IT is hoped to inaugurate the next stage of the electrification programme of the Southern Railway on June 17th. Electrically operated trains will then run to Epsom Downs, and certain routes on the old "Brighton" system which are now operated by overhead construction, will then be actuated by current from the third rail. In anticipation of that event, considerable changes will be made on June 10th in the lines between London Bridge and Bricklayers' Arms, and certain minor changes in the electrical operation of trains will be made on the latter date.

A LETTER which will appeal to railway engineers appeared in *The Times* of May 21st. It suggested the application of the flying junction, as used on railways, to the proposed new road from the Strand to the Cavell Memorial so that vehicles going from northwards of the memorial towards Waterloo and vehicles from the Strand going northwards would not cross each other. We believe that the first instance of a flying junction was that designed by Mr. William Baker, the chief engineer of the London and North-Western, when the new line from Liverpool—opened April 1st, 1869—was made to pass under the North main line and to join the up main line at Weaver Junction.

THE subway, or underground, railway of New York was built by the municipality under the supervision of the Board of Rapid Transit—as in the earlier similar work in Boston. Under the lease of February 21st, 1900, the Interborough Rapid Transit Company, the lessee, is bound to a maximum fare of 5 cents per passenger, regardless of the distance and whether other connecting lines have to be travelled over. Naturally, the railway company has wished to raise the fare in order to meet the increased expense of operation, but the city authorities have successfully resisted all attempts in that direction. Now, however, the Federal Statutory Court, in a decision announced on May 2nd, has held that a 7 cent fare would be legal.

THERE has recently been issued the report by Colonel Trench, of the Ministry of Transport, into the derailment of January 20th, outside Glasgow Central Station, of two coaches of a passenger train. Eighteen passengers complained subsequently of minor injuries or shock, but none of them made any report at the time of the accident. The cause of the mishap was the breakage of the leading axle of the trailing bogie of the first of the two vehicles in question. The report says that the coach was put into service in November, 1926, and was in the St. Rollox shops for periodical examination and overhaul in November, 1927, when no defect was observable during the inspection. The fracture occurred about 4¼in. inside the right-hand wheel and on the portion of the axle on which the manufacturer's branding was impressed. Examination after the accident showed that there was a growing flaw which had extended over about three-quarters of the section of the axle prior to the final fracture. The flawed surface was, however, clean, and did not indicate that the whole or any portion of it had been in existence for long. Examination of the structure of the metal by means of micro-photographs did not reveal any adequate cause of fracture. After remarking that similar failures have been attributed to the breakage of the skin at the branding, and recommending that the branding be at the end of the axle, Colonel Trench concludes that no blame should be attached to the inspecting staff concerned in connection with this breakage. The inspecting officer then draws attention to the examination of axles recently instituted by the London Electric Railways, in which a magnetic circuit is set up through the axle under test, with a view to detecting flaws which may be invisible to the eye. The apparatus appears to be compact and inexpensive, and the test takes less than 5 minutes.

Notes and Memoranda.

DURING 1927 the total sales of electricity for all purposes in Shanghai were 400,343,385 kilowatt-hours, as compared with 408,245,810 in the year 1926, a decrease of 1·93 per cent. The year's trading resulted in a net profit, after meeting interest and all other net revenue charges, of Tls. 2,292,554. The decrease in sales is attributable to the serious and long-continued state of disturbance which took place in the early part of the year, the institution of the curfew and the continuous industrial troubles reacting against the output. In view of these circumstances, the financial results may be regarded with a considerable degree of satisfaction, more especially when account is taken of the reaction against efficiency which the conditions involved.

BETWEEN sixty and seventy scientists and fuel technologists in eleven different countries, it is announced, have tentatively accepted invitations either to speak or to read papers at the Second International Conference on Bituminous Coal, which will be held at the Carnegie Institute of Technology in Pittsburgh, Pa., during the week of November 19th, 1928. The purpose of the coming congress is to present the results of recent studies of coal that have to do with improved methods of utilisation and combustion. The programme will include the discussion of low-temperature distillation, high-temperature distillation coal tar products, power, smokeless fuel, complete gasification of coal, hydrogenation, pulverised fuel and its new applications, fixation of nitrogen, coal beneficiation, &c.

EXPORTS of coal in April amounted to 3,722,000 tons, compared with 4,111,000 tons in March and 4,118,000 tons in April, 1927. In addition, coal shipped as bunkers for steamers engaged in the foreign trade, including fishing vessels, amounted to 1,363,000 tons in April, 1,379,000 tons in March and 1,315,000 tons in April, 1927. The average value per ton of coal exported was 15s. 9d. in April and March and 18s. 6d. in April, 1927. Comparing the distribution of our exports of coal in April with those in April last year, the only substantial increases shown were in the exports to Germany, which country took 431,000 tons compared with 256,000 tons a year ago, and Brazil—118,000 tons against 65,000 tons. The heaviest reductions were in the exports to Scandinavia, Italy and France.

THE total recorded world's production of diatomaceous earth, states a recent Imperial Institute monograph, is of the order of 100,000 tons only per annum, but returns are very incomplete. No official figures are available for Danish "moler" production, although large quantities are obtained. The German production, which is considerable, is also unavailable, but a large allowance must be made for consumption in that country. The United States produces over 70 per cent. of the world's total, and consumes the greater part of its output. Owing to the fact that there are many small producers in Algeria, exact figures for production in that country are not available, but it is the second largest producer. The chief consuming countries are the United States, Germany, the United Kingdom, and France. New uses for the earth are continually being found, and the consumption is steadily increasing.

IN a discourse delivered before the Royal Institution on Friday, May 25th, on "Engine Knock and Related Problems," by Mr. A. C. Egerton, F.R.S., it was explained that "knocking" was a sound which came from the cylinder of an internal combustion engine during the abnormal explosion of the charge. It limited the compression of the charge and therefore the efficiency of the engine. The efficiency could be improved (*a*) by suitable engine design; (*b*) by the admixture with the petrol fuel of large percentages of non-knocking fuel, such as benzene; or (*c*) by the addition to the petrol of small quantities of "anti-knocks," such as lead tetraethyl or iron carbonyl. Thus the function of an anti-knock was to make possible the use of higher compressions in the engine, thereby increasing the efficiency and preventing the unnecessary wastage of large quantities of petrol fuel. It was, explained Mr. Egerton, Sir Humphry Davy who, at the Royal Institution, first drew attention to the influence of small quantities of combustible substances on the combustion of other mixtures. The remarkable features of anti-knocks, such as lead tetraethyl or iron cabonyl, were the small quantities needed to be effective—one part in 200,000 of the fuel and air mixture—and, secondly, the fact that although they deadened down explosion, they themselves, in the pure state, were highly inflammable and explosive substances.

ACCORDING to the *Chemical Trade Journal and Chemical Engineer*, aluminium powder, erroneously called aluminium bronze in the United States, is acquiring an ever-increasing industrial importance. There is only one method available for its satisfactory production, and that is to submit the metal to pressure in such a way that it is divided into very small pieces which have the shape of spangles or shining platelets. By this process a polishing effect is also imparted, to which the metal owes its lustre. If direct grinding methods are employed, a powder is obtained which is by no means so lustrous as the spangles, so that any direct grinding action should be avoided. The metal is usually hammered in specially constructed stamp mills. The aluminium must be pure—99 per cent. and over. Impurities, such as iron and silicon, make it hard and unsuitable for treatment in the stamp mills. In addition, these metals form alloys with the aluminium which are coloured blue and grey, and so detract from the lustre of the powder. In the hammering process it is readily intelligible that the minute spangles receive lines and other impressions from the machinery, but it is precisely these irregularities on the surface of the spangles which contribute to their intensified reflexion of incident light, and so to the lustre of the powder. The thickness of the spangles varies between a fourth and a five hundredth part of a millimetre, and the ratio which the diameter bears to the thickness varies between 200 : 1 in the case of good quality powders to 5 : 1 in the case of poor quality powders. The tougher the spangles the better the quality of the material, and this toughness is largely dependent upon the purity of the metal used.

Miscellanea.

LAST year was a period of marked prosperity in all the domains of Poland's economic life and of increased consolidation and general stabilisation, writes Mr. R. E. Kimens, C.M.G., British Commercial Secretary at Warsaw. Goods in demand include machinery of all kinds, colonial produce, chemicals and textiles.

A ROYAL Commission will inquire into broadcasting throughout Canada, and advise as to its future administration and control. The Government is contemplating control, based on the British system, with public ownership of all broadcasting stations. A sum of 250,000 dollars (£50,000) has been voted for ship-to-shore wireless telegraph stations.

THE reference to the Supreme Court of the question as to whether the water powers in Canada are under the jurisdiction of the Dominion or the Provinces is regarded by the judges as one of the most important cases ever brought before them. The hearing was to commence on May 28th, but it is anticipated that judgment will not be delivered until October. The question is of vital interest in connection with numerous projects for power development which will be affected.

THE Government of Colombia, South America, which recently effected a loan of 60,000,000 dollars for railway construction and public works, has awarded to the P. Lyall and Sons Construction Company, of Montreal, the order for the building of a railway between Tunja and Belez, the value of which is stated at approximately 20,000,000 dollars. There was keen competition for the work by a number of European and American contracting firms. It is understood that it will take two or three years to complete the work.

THE light cruiser "Shropshire," which William Beardmore and Co. (Ltd.), Dalmuir, are building to the order of the Admiralty, is to be launched on Thursday, July 5th, by the Countess Powis (Baroness Darcey de Knayth in her own right), wife of Earl Powis, Lord-Lieutenant of the County of Shropshire. The new vessel is one of the new "County" class of 10,000-ton British cruisers, of which the "Norfolk" is being built at Fairfield, the "Sussex" at Hebburn-on-Tyne, the "Devonshire" at Devonport, and the "London" and the "Dorsetshire" at Portsmouth. The vessels are understood to be 630ft. in length overall, and to be similar to the cruisers of the "Kent" class, but without external bulges.

AN official notice (170A) issued by H.M. Commissioners of Customs and Excise points out that Notice 170 of April stated that it was proposed to provide in the Finance Bill for the repayment of duty paid on hydrocarbon oil consumed in agricultural tractors used in the cultivation of arable land. This proposed allowance was made primarily in view of the fact that kerosine forms the great bulk of the oils used in agricultural tractors, petrol, benzol, &c., being used in relatively very small quantities. Kerosine having been excluded from the duty by a resolution passed on May 1st, the small amount of duty which will now fall upon users of tractors would not justify the establishment of the special official machinery necessary to enable repayments to be made. Accordingly no repayments will be allowable in respect of any oils.

THE position in the coal-mining industry during the first quarter of 1928 was not markedly different from that of the last quarter of 1927. Output was 1¼ million tons higher, but shipments were ¼ million tons lower. Prices both for export and inland were still falling, although the rate of decline was slower than during the previous quarter. The number of persons employed continued to decrease, but there was a small improvement in the regularity of employment. The average number of persons employed during the quarter fell by 17,000, as compared with a drop in the December quarter of 9000. Ten and a-half days were lost by the pits through want of trade—an improvement of two days over both the September and December quarters of last year. The amount of coal retained for home consumption was higher by two million tons.

TOKYO, the first city of the Orient to adopt the subway as a means of solving traffic problems, opened the first link of an underground system to the public at the end of December, 1927. The enthusiasm of the populace over the inauguration of what was to them a most novel scheme of travel was so great that close to 100,000 passengers crowded the trains and stations on the opening day, and many rode repeatedly back and forth. The new subway connects two thickly populated sections of Tokyo for which surface lines had become inadequate, the terminals being at Ueno and Asakusa. In its construction and equipment, the engineering features and general appearance are very similar to those of the subways of New York City. The excavation was open cut, and roofed over with steel. It is of rectangular section and is situated comparatively near to the surface. The stations, even to the set spaces for advertising on the walls, are like those of New York City, and similar turnstiles of the coin-in-the-slot type are used.

DETAILS of the projected Pykara hydro-electric power scheme show that it is one of the most comprehensive yet thought out in connection with India's great untapped water power. The object of the scheme, states the *Electrician*, is to utilise, for the development of electric power, the fall of 2050ft. of water where the Pykara descends to the plains below from the Nilgiris, about fourteen miles from Cotacamund. From the Mysore embankment it is proposed to transmit power by overhead lines to Coimbatore, Pollachi, Trichinopoly and Madura and neighbouring area, though Madura may be left out at the moment. The scheme provides for a dam about three miles above the fall. This dam will have a storage capacity of not less than 4000 million cubic feet, and other storages will be provided against drought. The total fall to be obtained is about 3088ft. It is proposed to install three generating sets, each of 7500 kW capacity, and, when necessary, increase to five sets, and a further provision is to be made for two sets of 15,000 kW should demand justify it. The total installed power will be 67,000 kW. The transmission power will be at 110,000 volts, to be increased to 130,000 volts.

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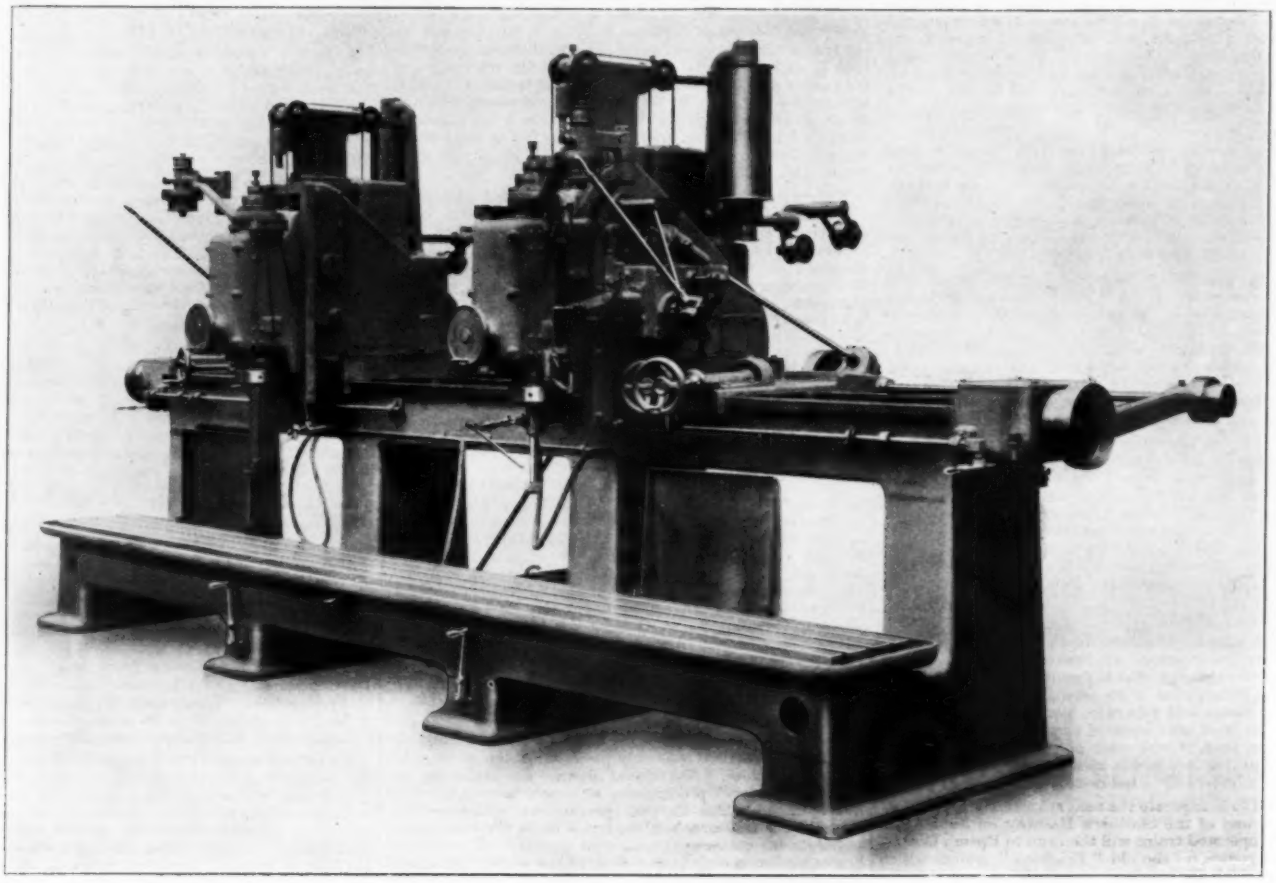

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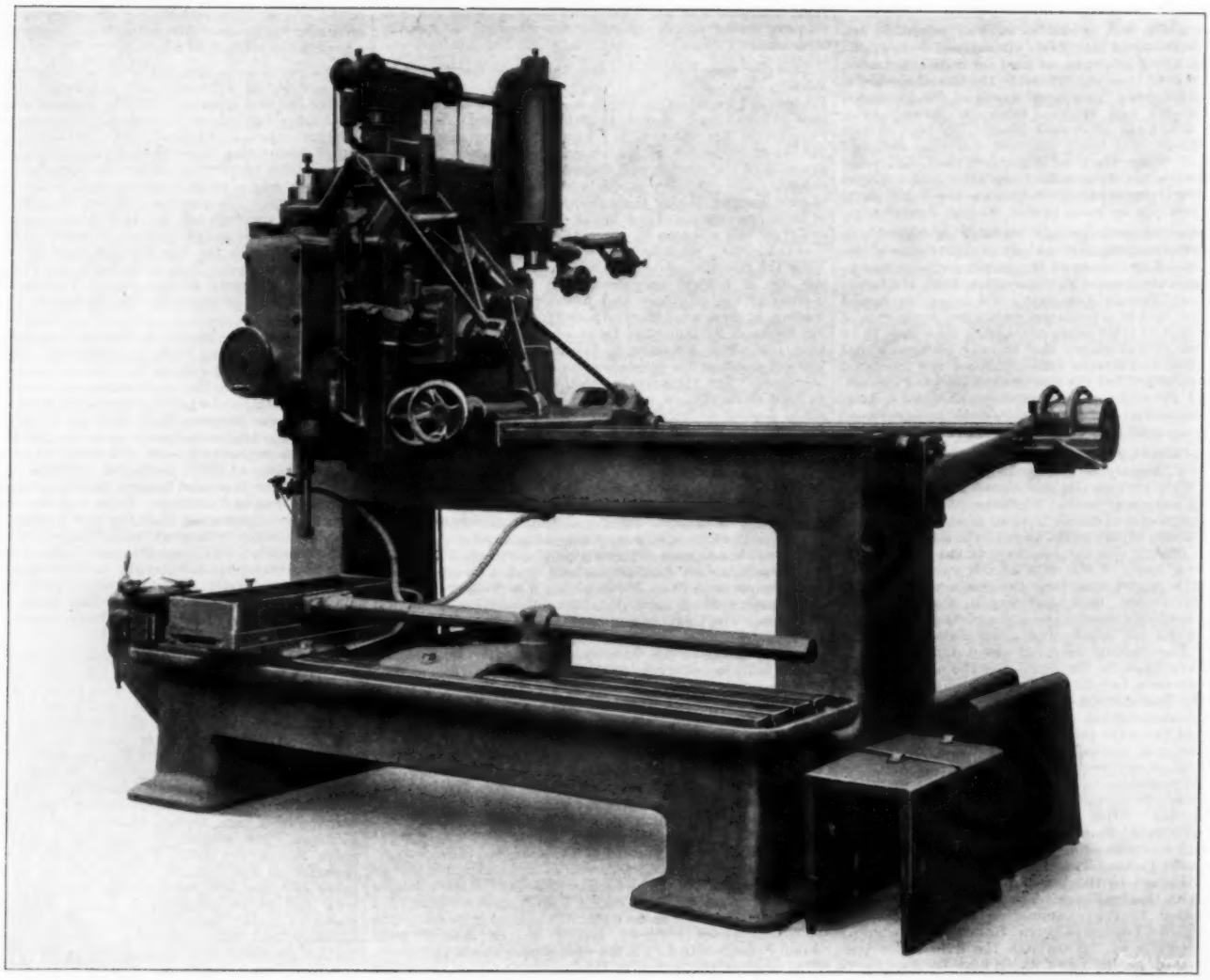

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NOTICES TO READERS.

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DEATH.

On May 28th, at Mary Tavy, Devon, RICHARD JAMES CHURCH, M. Inst. C.E.

THE ENGINEER.

JUNE 1, 1928.

Engineering in 1828.

THE conference which is being held next week by the Institution of Civil Engineers in connection with the celebration of the incorporation of the Institution by Royal Charter will bring together a distinguished body of engineers, and will be the most important engineering conference of the year. On the three days devoted to the reading and discussion of papers, no fewer than thirty subjects will be dealt with, and it may be expected that when the proceedings are published, we shall have a valuable collection of material which will fully represent the authoritative opinion of to-day. The subjects to be discussed range over the whole field of civil engineering—constructional engineering, power engineering, and municipal engineering—in their widest aspects. In the Charter of 1828 civil engineering was stated to be "the art of directing the great sources of power in Nature for the use and convenience of man," and ever since, in spite of the rise of many other engineering institutions, the Institution of Civil Engineers has provided a platform for most of the greatest engineers of our country. The addresses of the various Presidents of the Institution of Civil Engineers probably contain the material for a great history of engineering during the last hundred years, though that history remains to be written. In the circumstances, it may therefore be of interest to review briefly some of the activities of the engineering world a century ago, and recall some of the great pioneers who laid the foundation of the vast engineering edifice of to-day.

First among the activities of the civil engineer in 1828 were those of construction. In all parts of the country roads were being laid down, bridges erected and docks, harbours, lighthouses and breakwaters being built. The *doyen* of the profession was William Chapman, who in 1828 was seventy-nine years of age. A dock and harbour engineer, he was joint engineer with Rennie on the London docks. His contemporary, William Jessop, builder of the Surrey Iron Railway, the first public railway in the South of England, had died in 1814, while Rennie had passed away in 1821. Of Rennie's great bridges, Waterloo Bridge was completed in 1817, and Southwark Bridge in 1819, while the construction of London Bridge was in 1828 drawing to its conclusion. His son, Sir John Rennie, who finished London Bridge, and also the great breakwater at Plymouth, was the first engineer since Myddleton to be knighted. Of our great road makers, McAdam at the age of seventy-two was Surveyor of Roads, while Telford, a year his junior, had in 1826 finished his suspension bridge over the Menai Straits and was building the bridge at Gloucester. It was Telford's assistant, Joseph Mitchell, who took the first notes for the "Proceedings" of the Institution of Civil Engineers. Tunnel construction was in its infancy, but in 1828 there was no bolder piece of work in progress than Brunel's tunnel under the Thames, begun in 1825, but not finished till 1843. The first twenty-five years of last century saw great activity in dock building and to the docks of London were added successively the West India Docks, the London Docks, the East India Docks, Commercial Dock, and St. Katherine's Dock. Of those who followed in the footsteps of Smeaton, mention should be made of Robert Stevenson, builder of the Bell Rock lighthouse, and the famous father of three famous sons—Alan, David and Thomas—and grandfather of Robert Louis Stevenson, who also began life in an engineer's office. Another well-known civil engineer, Rendel, in 1828 was fast rising to fame for his work in the south-west, while it was the Yorkshireman, Joseph Aspdin, who made the world his debtor by the discovery of the method of producing Portland cement, patented by him on October 21st, 1824. But whatever was the demand for roads, bridges, breakwaters and harbours, it was to be immensely increased by the great constructional works called for by the inauguration and development of our railway system, the growth of which coincided with the early days of the Institution of Civil Engineers. Railways had existed for two centuries, but Trevithick's locomotives only made their appearance during 1804–08. Trevithick himself in 1828, however, had just returned from his eleven years' pilgrimage in South America, but took no part in the movement he initiated. In 1828 Blenkinsop, whose engines at Leeds had been in use since 1812, was forty-five years of age; Hedley, who built "Puffing Billy," was forty-nine; Rastrick was forty-eight, and George Stephenson forty-seven. Stephenson himself was then busily engaged with the construction of the Liverpool and Manchester Railway, while Robert Stephenson, just home from the Columbian mines, was occupied with the famous locomotive factory at Newcastle.

Other nations have had great road makers, bridge builders and constructors of harbours, but locomotive building was almost peculiar to this country. Mr. Dendy Marshall says in his recent hitorical essays, that up to the middle of 1831, ninety engines had been constructed in Great Britain, and only ten in the rest of the world, and they, moreover, had little influence on the development of the locomotive. The railway systems of the world really began with the Liverpool and Manchester Railway, and that line was the training ground of many an engineer who afterwards rose to fame. As a practical commercial undertaking, steamboats antedated the steam railway, and by 1828 steam vessels ran on all our rivers, cruised around our coasts, connected our ports with the Continent, and though long ocean voyages by steam alone were still impracticable, steamboats were found in all parts of the world and men had begun to plan steam vessels for crossing the Atlantic. The oldest of our steamship companies, the General Steam Navigation Company, goes back to 1824. In 1825, with Lieut. Johnston in command and William Ash as chief engineer, the "Enterprize," built at Deptford and engined by Maudslay, accomplished the voyage—partly by steam, partly by sail—to India, and in 1828 the Navy not only placed the names of the "Lightning," "Meteor," and "Echo" in the official list of the Navy, but also laid down H.M.S. "Dee," the first British steam-driven vessel designed as a fighting ship. In 1828, however, the finest steamship in the world was the "United Kingdom," 160ft. long, built at Greenock and engined by David Napier. Her engines developed 200 horse-power. The "United Kingdom" was spoken of as "the first of the leviathan class," and cost about £40,000. In size, power and magnificence marine engines have necessarily surpassed the

locomotives, and on the Clyde, Mersey, Tyne and Thames great establishments arose devoted principally to their construction. Rennie in his presidential address to the Institution of Civil Engineers in 1846 mentions Robert Napier, David Napier, Tod, Caird, Sinclair, Girdwood, and Scott, of the Clyde; Fawcett, Bury, Fairbairn, and Forester, of the Mersey; while among the marine engineers of the Thames he gives the names of Maudslay, Field, Miller, Barnes, Seaward, Penn, and Ravenhill. Many of these, it should be remembered, were among the pioneers of iron shipbuilding, and the industries they founded, whether as builders of ships or builders of engines, have ever since been of the greatest importance to this country.

Of the many activities of the engineers of a century ago it is only practicable to touch upon a few. One of the burning questions of to-day is that of the use of high-pressure steam, yet it should be remembered that Jacob Perkins in 1828 was using uniflow engines driven by steam generated at several hundred pounds pressure in water-tube boilers. In 1828, though the beam engine still held sway, many types of engines were in common use. Engineers, however, were still in the dark as to what happened in a heat engine. Carnot's essay of 1824 lay unnoticed for twenty years or more, and in 1828 Regnault was but eighteen, Joule but ten, Rankine but eight years of age. Another pioneer of the water-tube boiler was Goldsworthy Gurney. Captain John Ross, in his book on "Steam Navigation and Steam Tactics," the first of its kind, proposed the use of Gurney's boilers for the Navy, and in this work, published in 1828, he lays it down that "it is manifest that the machinery which is the least complicated, and least liable to derangement, which affords the most power in proportion to the space it occupies, which possesses the least weight, which is most speedily brought into action, and which consumes the least fuel, is that which ought to be adopted for the Service." Of the pioneers of gas lighting Murdock still directed the fortunes of the Soho Works; Winsor, to whom a cenotaph was afterwards erected in Kensal Green Cemetery bearing the words "At evening time it shall be light," was some sixty-five years of age; while Samuel Clegg had for many years been actively engaged in erecting gasworks at home and abroad. In the iron industry the outstanding event of 1828 was the grant of a patent to Neilson, Macintosh and Wilson for the system of iron smelting by hot-blast. Neilson was the inventor and at that time he was manager of the Glasgow Gasworks. In 1828 the blast-furnaces of Scotland produced some 30,000 tons of pig iron at about £7 a ton; by 1864 the output was over 1,160,000 tons, and the price under £3 a ton. Neilson's invention also made available the black band ironstone discovered by David Mushet. In 1828 Bessemer was but fifteen years of age.

Another rapidly growing branch of engineering in 1828 was that of machine tool making, and as a training school for the mechanical engineer there was no shop equal to that of Maudslay's in Lambeth. It was the Mecca of the young and enterprising mechanic. Whitworth had entered the service of Maudslay shortly after his marriage in 1825 and next to John Hampson was reckoned Maudslay's best workman. In 1833 Whitworth left London for Manchester, where over the door of his shop was written "Joseph Whitworth, tool maker from London," but his great discovery of the method of producing truly plane surfaces, which established an entirely new standard of accuracy in machine work, was made at Lambeth. Nasmyth did not enter Maudslay's employ till 1829. Another clever tool maker of the time was Joseph Clements, who for years assisted Babbage on the famous calculating machines which were the most wonderful mechanical appliances of the age, not surpassed by the printing machines of Köenig and of Cowper, or the paper machines over which Fourdrinier spent some £60,000 and thereby brought himself to bankruptcy. Yet one other aspect of engineering of 1828 may be touched upon. Of technical education there was little, of Chairs of Engineering there were none, and of data for the guidance of the practical engineer, such as existed, was contained in books often too abstruse for his comprehension. The education of workmen in Great Britain may be said to have begun with the foundation of the Andersonian Institution in Glasgow in 1796, which gave rise to the Birkbeck College and the various Mechanics' Institutions throughout the country. Of the mathematicians and writers to whom engineers of the day were indebted Barlow, of Woolwich, was one of the chief, while the writings of Tredgold and afterwards Eaton Hodgkinson became widely known. Of Tredgold's "Elementary Principles of Carpentry" it was said "it was the first serious attempt in England to determine practically and scientifically the data of resistance." His essay on "Cast Iron" of 1822, his book on "Warming and Ventilation" of 1824, and his work on "The Steam Engine" were found in many an engineer's library. Beginning as a journeyman carpenter, Tredgold died in January, 1829, at the age of forty, worn out by study, having, however, left his mark on engineering literature. A year junior to Tredgold, Hodgkinson turned from studying for the Church to engage in business, but wrote papers for the Manchester Literary and Philosophical Society. It was in one of these in 1822 that he first introduced the idea of "permanent set." A paper he wrote in 1828 for the Society was entitled "On the Forms of the Catenary in Suspension Bridges." Two years later he published his "Theoretical and Practical Researches to Ascertain the Strength and Best Forms of Iron Beams"—"one of the most valuable contributions to the study of the strength of materials ever made." Hodgkinson was years afterwards a Professor of Engineering in University College, London, but the first to occupy a Chair of Civil Engineering in that College, and indeed in the whole country, was Vignoles, who was made a Professor in 1841. Thirteen years had then passed since the incorporation of the Institution of Civil Engineers, and the higher education of engineers was already becoming a matter of importance.

In the course of the hundred years which have elapsed since the Institution of Civil Engineers received its first charter the world has undergone astounding changes, but of those changes none is more remarkable than the means which have been provided for facilitating the intercourse between the nations of the earth. Throughout the first quarter of last century Great Britain—as the brief record we have given shows—led the world in the improvement of the means of communication and was behind no other land in the construction of roads, bridges, docks, water supply and sanitation. We may look back to that period, and indeed to at least the first half of the nineteenth century, as the heyday of British engineering. To no single nation can such a wonderful period come again. The engineer himself has borne down international boundaries. The splendid isolation in which British engineers stood for a time is a thing wholly of the past. Engineering has become an international science, and whilst many nations may be able a hundred years hence to look back upon the present and to give a long list of the names of famous men, none ever again will be able to claim to itself alone so many pioneers in the invention and introduction of engineering works and productions for "the use and benefit of man."

Literature.

Pitman's Technical Dictionary of Engineering and Industrial Science in Seven Languages. Edited by ERNEST SLATER. London: Sir Isaac Pitman and Sons, Ltd. Price of each part 2s. 6d. net.

THIS comprehensive dictionary of many branches of industry, technology, and science is being published in about thirty-six fortnightly parts, and the complete volume will contain two million words rendered in seven languages. It has been compiled by Mr. Ernest Slater, the editor of our contemporary, the *Electrical Times*, in collaboration with leading authorities in various parts of the world. It is the work of many men and many years, particularly the last ten or twelve years, which have seen such revolutionary advances in engineering and caused such vast additions to technical nomenclature that few of the dictionaries compiled twenty years ago or more are of much practical assistance. During the period between 1914 and 1924 almost a new world in technology was created, and for this, if for no other reason, the scope and contents of this new publication may be regarded as unique.

The languages covered are English, French, Spanish, Italian, Portuguese, Russian, and German. The dictionary is arranged upon the basis of the English version; that is to say, against every English term the equivalents in the six other languages are given; together with such annotations as may be necessary to show the exact use of the term in any or all of the languages. Moreover, the dictionary is not limited to the literal or forced translations of the translator, but it gives the actual terms current in the various countries. The long list of acknowledgments in the prefatory pages shows that every endeavour has been made to secure accuracy and to make the dictionary as complete and useful as possible. The publishers claim in fact that that no other dictionary has such a weight of official authority behind it.

Another noteworthy feature is that the work is conveniently arranged and immediate reference is secured by simply turning to the alphabetical page upon which the required word or phrase occurs, and the arrangement does not necessitate referring backwards or forwards to a key index. Altogether the dictionary is a very creditable production, and it should prove of great value to engineers.

Commercial Electrical Measuring Instruments. By R. M. ARCHER. London: Sir Isaac Pitman and Sons, Ltd. Price 10s.

WHILE there is no lack of books on electrical instruments, the present volume seems to meet the requirements of students exceptionally well, and it should also appeal to others. It has been prepared from lectures given by the author whilst in charge of the Electro-Technical Department of the Derby Technical College, and it is intended for users of instruments rather than those who may have to make them. All things considered, the book seems to meet the requirements of very many people, for although it cannot be said that it is suitable for those with no electrical knowledge, it is written on simple lines. More attention is paid to principles than to details of construction, which are dealt with in other books. Having considered first principles, the author goes on to discuss moving iron instruments, screening, dumping devices, instruments with moving coils, moving coil instruments with permanent magnetic fields, moving coil instruments of the dynamometer type, hot-wire instruments, electrostatic voltmeters, the use of ammeters and voltmeters in special cases, the measurement of alternating current and voltage, the measurement of A.C. power, induction type instruments, general considerations, and operating characteristics, the selection of instruments, recorders and miscellaneous instruments. The bibliography at the end of the volume will be useful to those who, having read the book and obtained broad general ideas on measuring instruments, wish to make a serious study of certain types. The book contains a considerable number of drawings and diagrams, all of which are of value to the reader. Pictures showing the external appearances of instruments, such as those to be found in makers' catalogues, are not included, and in this respect the volume differs from many others that have come before our notice. All the space the author has had available has been devoted to good technical information, which should prove of service to those who are about to take up the study of this fascinating subject.

BOOKS RECEIVED.

R. E. Crompton: Reminiscences. London: Constable and Co., Ltd., 10-12, Orange-street, W.C. 2. Price 14s. net.

Beyond the Electron. By Sir J. J. Thomson. London: The Cambridge University Press, Fetter-lane, E.C. 4. Price 2s. 6d. net.

Studies in Molecular Force. By H. Chatley, D.Sc. London: Charles Griffin and Co., Ltd., 42, Drury-lane, W.C. 2. Price 7s. 6d. net.

How to Tend Saws, Knives and Cutters. Fifth edition. London: John Heywood, Ltd., 20-22, Bride-street, E.C. 4. Price 2s. 6d. net.

The Abrasive Handbook. By F. B. Jacobs. London: The Penton Publishing Company, Ltd., Caxton House, S.W. 1. Price 25s. net.

Alfred Yarrow: His Life and Work. Compiled by Lady Yarrow. London: Edward Arnold and Co., 41, Maddox-street, W. 1. Price 5s. net.

"Hütte" Des Ingenieurs Taschenbuch No. III. Twenty-fifth, Jubilee, edition. Berlin. 1928. Wilhelm Ernst und Sohn. Price 15·60 marks.

The Gamecock Aeroplane: Jupiter VI. Engine. London: His Majesty's Stationery Office, Adastral House, Kingsway, W.C. 2. Price 1s. 6d. net.

An Introduction to Physical Science. Second edition. London: The Oxford University Press, Amen House, Warwick-square, E.C. 4. Price 4s. net.

The Journal of the Franklin Institute, May, 1928. Philadelphia: The Franklin Institute of the State of Pennsylvania, 15, South Seventh-street, Pa., U.S.A.

An Investigation of a Rotating Radio Beacon; Radio Research Report No. 6. London: His Majesty's Stationery Office, Adastral House, Kingsway, W.C. 2. Price 2s. 3d. net.

Proceedings of the Chemical Engineering Group. Volume VIII., 1926. London: The Chemical Engineering Group, Abbey House, Victoria-street, S.W. 1. Price 10s. 6d. net.

Kelly's Directory of the Merchants, Manufacturers, and Shippers of the World. Forty-second edition in two volumes. London: Kelly's Directories, Ltd., 186, Strand, W.C. 2. Price 64s. net.

Union des Ingénieurs sortis des Ecoles Spéciales de Louvain. Revue Trimestrielle, 15e Avril, 1928. 1e *Bulletin Technique.* Louvain, Etablissements Fr. Ceuterick, 60, Rue Vital Decoster.

Integral Waterproofing Compounds for Concrete. By Maurice B. Lagaard; *being Bulletin No. 6 of the Engineering Experiment Station of the University of Minnesota.* Minneapolis, Minn. 1927. Published by the University.

"Hütte" Des Ingenieurs Taschenbuch. Complete index to Volumes I. to IV. Berlin. 1928. Wilhelm Ernst und Sohn. Price 2·50 marks.

The Avonmouth Dock Extension.

No. III. (*Conclusion*).*

WE conclude, below, our description of the extension of the Royal Edward Dock at Avonmouth, which was opened by H.R.H. the Prince of Wales on Wednesday last, May 23rd. When the Prince, who wore the uniform of Master of the Merchant Navy and Fishing Fleets, had embarked in the R.M.S. "Bayano," which was lying at one of the quays in the Royal Edward Dock, the vessel left her berth and was taken across the dock to the new arm. Moving slowly under her own steam the ship broke a silk cord stretched between the two wharves and entered the extension.

The Prince disembarked as soon as the "Bayano" had been berthed alongside the quay in front of transit shed U, and proceeded to a dais, which had been erected at the head of the dock, where he joined in a short ceremony and declared the dock extension open.

GRAIN-HANDLING APPLIANCES.

The main contract for the grain-handling machinery, including the belt conveyors and the quay-side pneumatic grain-discharging machinery, is being carried out by Henry Simon, Ltd., of Manchester. The large automatic grain weighers and the weighers for bulk delivery to small craft have been made by W. and T. Avery, Ltd., of Birmingham. All these appliances are now in course of erection.

Belt Conveyors.—The intake bands each have a nominal capacity of 200 tons of wheat per band per hour. There are at present two bands in front of shed V, four in front of shed U, and five at the open berth between U and the transit granary. The bands are 24in. wide of two-ply canvas covered on both sides with rubber and are run at a speed of 800ft. per minute. The small barge-loading conveyors at No. 3 granary have a capacity of 60 tons per hour, and are 18in. wide; in other respects they are generally similar to the main conveyors. The latter are continuous throughout the whole length of the gallery, but are arranged so that those on the water side can throw off to the bands in rear at convenient points, leaving the water-side bands free for the discharge of a ship—see Figs. 26 and 27. The maximum capacity available with the bands at present installed is thus five bands for the three berths.

The conveyors are driven directly from the countershafts of geared motors by means of Renold chains, a separate motor, varying in power from 5 horse-power to 30 horse-power, being provided for each conveyor—see Figs. 26 and 27. The chain drives are completely enclosed in dust-tight cases and the chains run in oil baths. Where practicable the drive is arranged at the delivery end of the conveyor. The driving pulleys throughout are 27in. diameter by 26in. face, of cast iron, with the driving face covered with rubber.

All conveyors are provided with belt-tightening gear, ranging in travel from about 2ft. 6in. to about 10ft. In the shorter conveyors, *i.e.*, up to about 200ft. long, this gear is of the screw and hand-wheel type, but for conveyors above 200ft. long deadweight tensions are used. The simplest form of this type of tension consists of a vertical steel frame from which cast iron weights are hung by means of a steel-wire rope. The rope passes round two sheaves into a horizontal position and the other end is attached to a four-wheeled carriage which supports the tail wheel of the conveyor. This arrangement is seen in Fig. 26 of the grain gallery in front of transit shed U. Four belts are seen in this view; the clear space on the left of the gallery provides room for the future installation of two additional belts. In certain cases, where, either owing to lack of space or to the fact that conveyors are in two tiers, this simple tension gear cannot be used, the tightening arrangements are placed elsewhere than at the tail end of the conveyor and the use of two or more idler pulleys is necessary. The construction of the framework employed for carrying the conveyor belts in single and double tiers is shown in some of the views given herewith.

Conveyors taking grain at several points, as in the case of the intake conveyors on the wharf front and those under the silos, are provided with a travelling feeding-on shoot consisting of a small steel hopper and feed shoe mounted on a steel frame with four wheels for running on the side rails of the conveyor. This feed hopper is fitted with a locking device to enable it to be clamped to the rails in any required position. The feed hoppers are seen in Figs. 28 and 32. The hopper is supplied with a wood cover fitted with a short canvas sleeve which is fastened round the feed shoot to prevent, as far as possible, leakage of dust.

The conveyors over the silos are provided with travelling throw-off carriages, whereby grain can be delivered at any desired point or to any particular bin. These throw-offs consist of a steel-framed carriage on four cast-iron wheels, the two front wheels being provided with machine-cut spur wheels. On the frame are mounted the two pulleys diverting the belt from its normal horizontal position, the shoot into which the grain is discharged on leaving the belt, the

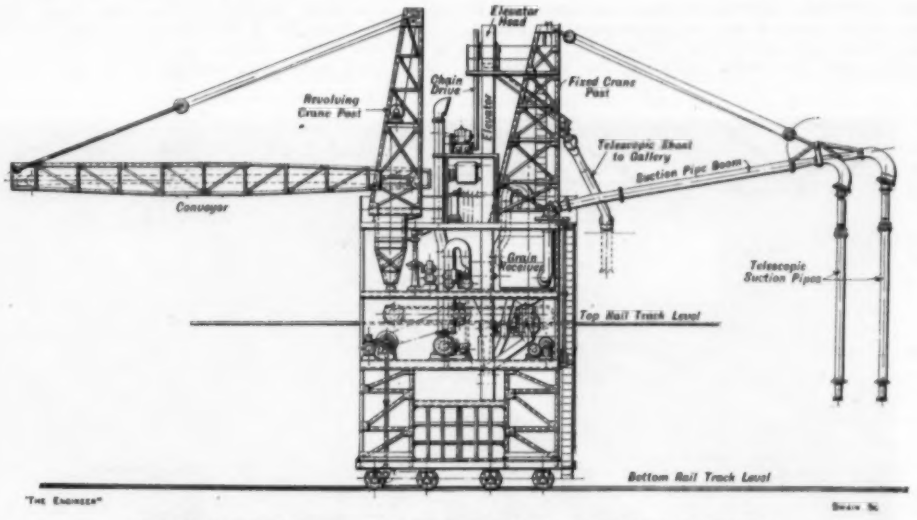


FIG. 30—TRAVELLING INTAKE CONVEYOR AND PNEUMATIC ELEVATOR

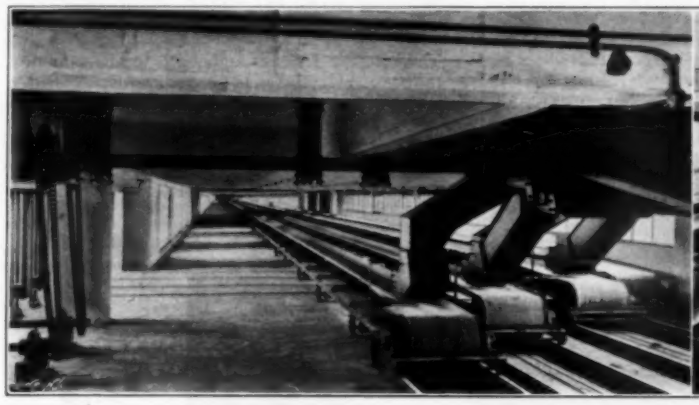


FIG. 26—BAND-TIGHTENING GEAR AND JUNCTION BETWEEN CONVEYORS

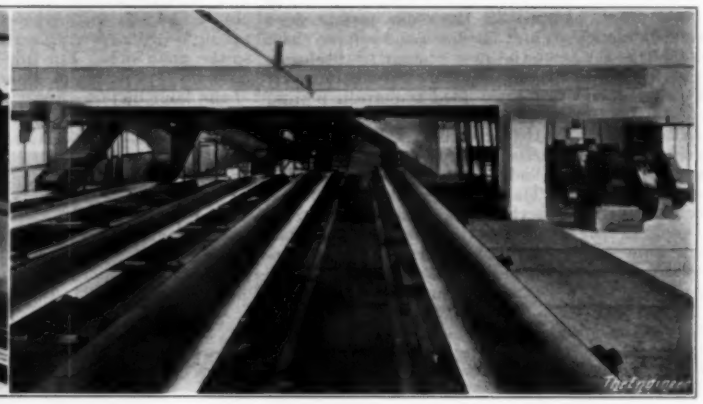


FIG. 27—CONVEYORS BETWEEN SHED U AND No. 3 GRANARY

FIG. 28—CONVEYORS BELOW STORAGE BINS IN No. 3 GRANARY

FIG. 29—DISTRIBUTING CONVEYORS OVER BINS IN No. 3 GRANARY

* No. II. appeared May 25th.

propelling gear and troughing, and the guide rollers. The power for propelling the carriages in either direction is supplied by the conveyor belt and is transmitted to the front pair of wheels. A locking device is provided for clamping the throw-off carriage to the conveyor side-rails. Several of these machines will be seen in the views of the conveyors over the bins in Nos. 3 and 4 granaries—Figs. 29 and 30.

Advantage has been taken of the opportunity afforded by the linking up of the belt systems between the new and the old granaries to speed up the older grain-handling machinery from its original capacity of 100 tons per hour to an anticipated capacity of 160 to 170 tons. The galleries of the older system were formed underground and arrangements have been made for the bands of the new system to discharge when required into the old tunnels. For this purpose fixed throw-off shoots are provided at certain points. The whole belt system of the Royal Edward Dock has, in fact, been cleverly interlinked.

Elevators in Granaries. — The elevators in the granaries have 22in. belts of six-ply cotton-duck covered with rubber. The buckets are 21in. wide and spaced 12in. apart on the belts. Elevators up to 60ft. vertical height between terminal centres have pulleys 54in. diameter by 23in. face. The pulleys of elevators of greater height than 60ft. are 72in. by 23in. All pulleys are of wrought iron covered on the face with rubber. The heads of four of the elevators in No. 3 granary and the driving motors are seen in Fig. 16 on page 565. The casing is removed from that on the left and the elevator buckets are visible. The leg casing and the boot of each elevator is constructed of steel plates and the boot pulleys are 20in. diameter.

Automatic Weighing Machines.—Three bands discharge into 5000 lb. weighers—per tip of oats—and thence into the silos in No. 3 granary. Grain passed through these weighers can be transferred into granary No. 4 or into the adjacent Nos. 1 and 2. Two of the quay bands are arranged to discharge direct through connecting galleries between granaries Nos. 3 and 4 into No. 4, where the grain is weighed in 5000 lb. automatic machines. There are altogether five of these large weighing machines. Each machine is fed from an elevator and has an hourly capacity of 200 tons of heavy grain—see Fig. 23 on page 566 and Fig. 34 herewith.

The machines are of the Avery even-armed beam type. A feed control automatically prevents the machine working until there is at least sufficient grain in the top garner above the scale to make a full weighing. An automatic compensator allows for the weight of grain in the act of falling when the cut-off takes place at the moment of weighing, and an instantaneous self-balancing device is provided. By means of this arrangement weights are lifted or lowered by an electrically operated jack in the space of a few seconds, thus permitting the scale to be balanced at a moment's notice.

A weight printer is attached to each machine. By the pressure of a handle the starting number of the counter is printed on a numbered ticket. When the cargo of grain has been weighed the finishing number of the counter is also printed above the starting number, thus ascertaining the net number of weighings, which is translated into terms of weight. In addition, on the same ticket is printed the weight of the residue weighing at the end of each cargo. Thus there is permanently recorded on a numbered ticket the total net weight of a cargo or parcel of grain.

Five automatic weighers, each having a capacity of 500 lb. per discharge of oats, and an hourly capacity of 40 tons of heavy grain, are installed in No. 3 granary immediately underneath the storage bins in the west wing. These, as we have already mentioned, are used for bulk deliveries to small craft. The machines are arranged on overhead travelling framework, so that each weigher can be used to weigh from either of two storage bins. They are seen in the view Fig. 17, on page 565, and in Fig. 33. The grain, after being weighed, is discharged to the band conveyors below—Figs. 17, 18 and 22—and, as the weighers are each fitted with a stop counter, they can be set to weigh a predetermined number of weighings and then automatically stop until the counters are reset. A weight printer is also fitted to each of these machines. A feature of all these automatic weighers is the dust cover, which totally encloses the flow of grain, so that protection is provided against the escape of dust. The working parts, knife edges and bearings of the machine are outside the dust enclosure, are easily accessible and protected from the dust.

Return Conveyor.—In connection with the weighing and sacking-off plant under the loading bins of No. 4 granary arrangements have been made for taking away any residue from the loading bins back to the main silos. For this purpose travelling shoots have been provided in each wing, having three inlets of the same distance apart as the bin outlets, and one outlet to correspond—when the travelling shoot is under the silos—with a shoot from the loading floor to the conveyors beneath the silos. These three-way shoots are fed from the silos by means of portable swivelling shoots, and are mounted on a wheeled frame running on rails fixed along the entire length of the silo walls. The return conveyor in the gallery between Nos. 3 and 4 granaries is seen in the middle of the view, Fig. 19 *ante*.

Electrical Equipment of the Granaries.—The complete system of electric motor equipment for the new grain handling plant in the galleries and granaries represents about 2000 E.H.P. The contract for this part of the work was in the hands of Henry Simon, Ltd., the motors being made by the English Electric Company, Ltd., and the hand-operated starting gear by George Ellison, Birmingham. The conveyors and elevators are driven individually by electric motors, the current supply being 365 volts, three-phase, 50 cycles. Altogether, nearly eighty motors are employed of various powers up to 35 H.P. In all cases they are of the squirrel-cage pattern for direct switching on to the supply. They have, however, been specially designed to give a starting torque of twice full load without excessive rush of current. The starting gear throughout is of the "fool-proof" pattern, each starter having an isolating switch and complete interlock. The starters are mostly arranged in groups with a common bus-bar chamber to form a starting switchboard, which is fed direct to the bus-bars, thus avoiding a multiplicity of distribution board fuses.

FIG. 31—CONVEYORS OVER BINS IN NO. 4 GRANARY

FIG. 32—CONVEYORS BETWEEN SHED U AND NO. 3 GRANARY

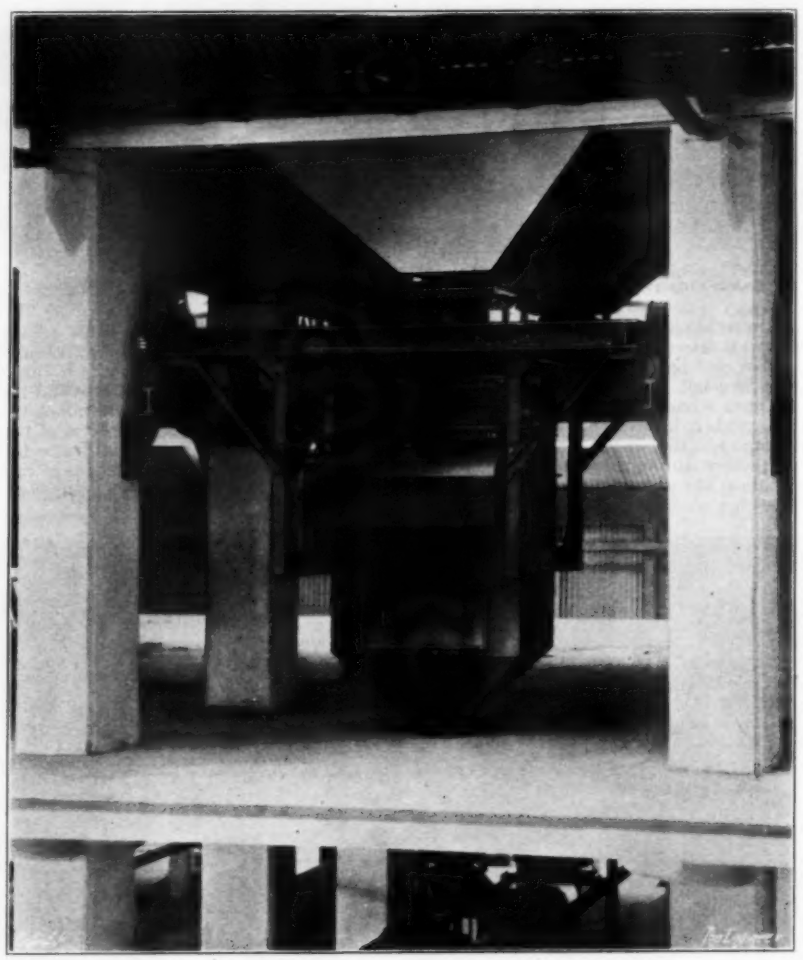


FIG. 33—TRAVELLING AUTOMATIC WEIGHING MACHINE IN NO. 3 GRANARY

TRAVELLING INTAKE CONVEYORS AND PNEUMATIC ELEVATORS.

There are three identical travelling pneumatic grain discharging plants combined with receiving conveyors which travel on a rail laid at the quay side

and an elevated rail carried on a girder and projecting brackets on the face of the grain gallery. These travellers perform a dual function. First, they carry intake telescopic band-conveyors—of 200 tons per hour capacity—which receive grain from floating elevators lying outside the vessel and feed it to the bands in the conveyor gallery through the openings in the windows already referred to. These openings are spaced at 25ft. intervals. Secondly, each traveller carries a pneumatic plant capable of dealing with 80 tons of wheat per hour. The discharge from the pneumatic plant is by bucket elevator and shoots through the opening in the face of the gallery adjacent to that occupied by the telescopic conveyor—see Figs. 15 *ante* and 30. There is also a fourth traveller which is designed to carry only a 200 tons per hour conveyor.

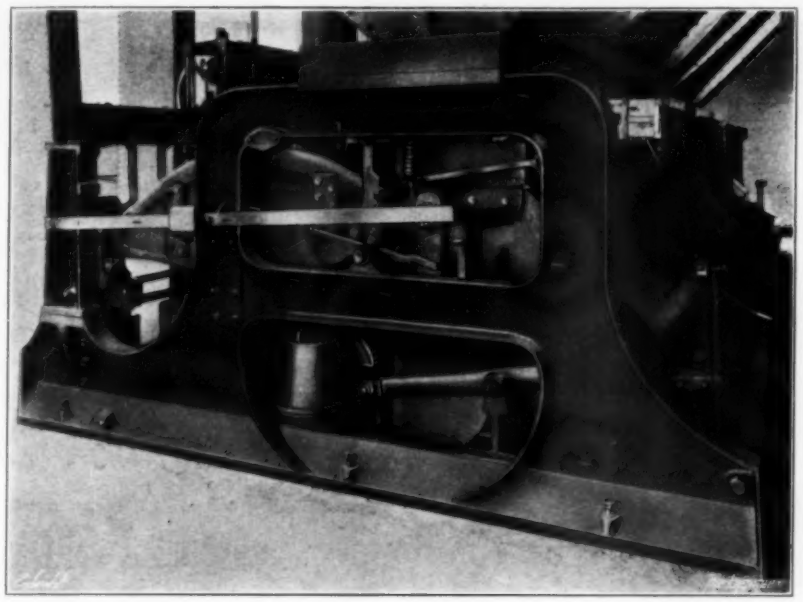


FIG. 34—AUTOMATIC GRAIN WEIGHER IN NO. 3 GRANARY

The pneumatic plants are intended, primarily, for the delivery of parcel cargo grain, and for cleaning up between decks and in similar spaces after the large floating elevators have dealt with the main bulk. They can also supplement the discharge of these elevators or can work in pairs through one hatch if necessary. The suction-pipe boom, the elevator shoot and the conveyor frame are carried on steel-framed structures erected on the top of the traveller. All three are arranged to slew and luff within wide limits. Each of the pneumatic travellers is provided with a high-speed two-stage turbo-exhauster in lieu of the reciprocating air pumps in use on the floating elevators. These exhausters are made by Reavell and Co., Ltd., of Ipswich and each is designed for a nominal duty of 4000 cubic feet of air per minute, at a vacuum of 11in. of mercury, when running at 8500 r.p.m. The power required under these conditions is approximately 110 B.H.P. A vacuum of 12in. can be obtained when necessary to clear chokes in the grain suction pipe. The motor of 130 B.H.P., is run at a loaded speed of 2950 r.p.m. and drives the exhauster through speed increasing gear of double helical type totally enclosed in an oil-tight casing arranged for forced lubrication.

In order to cope with special conditions such as when dealing with light grains, each plant is provided with a Reavell-Askania regulator, which, by means of a butterfly valve in the suction pipe, maintains the normal vacuum of 11in. of mercury on the exhauster side of the valve when the vacuum at the nozzle falls below the normal.

The clearance that is left under the semi-portal carriage of the travelling elevators is sufficient for the passage of railway wagons, &c. The total horse-power of the ten electric motors required for working the machinery of each of the pneumatic travellers is nearly 200. The largest motor is that driving the turbo-exhausters, which is 130 B.P.H. The motor for the travelling gear is 10 H.P. A 5 H.P. motor is sufficient for travelling the simple conveyor tower.

CRANES.

The transit sheds are, in the first instance, to be equipped with ten high-speed electric roof cranes. As already mentioned, these cranes are not yet in position. They are being built by Stothert and Pitt, Ltd., of Bath, and are of their horizontal-luffing type with balanced jib moved by cranks and connecting-rods. Eight of the cranes on the water side will lift 2 tons at a maximum radius of 65ft.; the two at the back of the sheds lift 2 tons at 28ft. Those on the water front traverse the full length of both sheds by means of the roof of the connecting gallery between the two buildings. The driver's cabins are arranged with a dual control position so that a clear view may be obtained when the jib is slewed in line with the shed.

CONCLUSION.

The whole of the works have been designed and carried out under the direction of the Chief Engineer to the Port Authority, Mr. T. A. Peace. The main contractors were Sir Wm. Arrol and Co., Ltd., of Glasgow. We are indebted to the engineer and his staff and to the several contractors for the particulars on which this account of the works is based and for the use of drawings and photographs.

With reference to the figures of capital expenditure which are given in the first part of this description of the dock extension—May 18th—we should add that the total capital expenditure on the Bristol dock estate to the present time is £8,650,000. The expenditure on the Royal Edward Dock, including the cost of the eastern arm to date, has been £4,816,000, and the total cost of the arm, when the mechanical equipment now in course of erection is completed, will amount to £1,325,000.

A NEW record for road construction has been set by America in the 195-mile continuous stretch of concrete road laid in Alabama. The 135-mile section on the Minnesota highway was previously rated as the longest in the world.

The Salving of the Ex-German Battle-cruiser Moltke.

AFTER a somewhat eventful voyage the upturned hull of the ex-German battle-cruiser "Moltke," from which the propelling machinery and the boilers had been removed, arrived safely in the basin at Rosyth Dockyard on Monday, May 21st, and was on Tuesday afternoon received into No. 3 Admiralty graving dock. The hull was rendered buoyant by means of compressed air and was towed from Scapa Flow to the Forth by three tugs belonging to the Bugsier Reederei und Bergungs A.G., of Hamburg. Now she is docked, the final dismantling of the ship will be undertaken by the Alloa Shipbreaking Company, Ltd., to which Cox and Danks, Ltd., have sold the wreck. The work of raising the ship in 72ft. of water off the Island of Cava, towing her to Lyness Pier, the taking out of her machinery and making her seaworthy and ready for towing to the Forth has occupied many months, and represents much skilled, patient, and often arduous work which has been carried out by the firm's staff at Scapa Flow under the personal direction of Mr. E. F. Cox. The feat of salving the "Moltke" is a notable one in the history of marine salvage undertakings, and all connected with it are to be congratulated on the success which has finally attended their continued efforts. Towards the end of last year we inspected the "Moltke" at Lyness when dismantling operations were proceeding.

THE SUNKEN BATTLE-CRUISER.

In company with other ships of the German fleet the "Moltke" was scuttled at her anchorage in Scapa Flow on June 21st, 1919, and she turned over and went down in over 72ft. of water off the western shore of the Island of Cava. Before describing the efforts made to float her a brief description of the cruiser and her armament may be given. The "Moltke" was a sister ship to the "Goeben" of Mediterranean fame, and she was built by Blohm and Voss, of Hamburg, being commissioned in 1912. She had a water line length of 610ft. 9in. with a beam of 96ft. 9in. and a displacement of about 23,000 tons. Her propelling machinery comprised a four-shaft arrangement of Parsons type turbines, designed for an output of 70,000 S.H.P., and steam was raised in twenty-four water-tube boilers of the Schulz-Thornycroft type, arranged for coal firing. The main side armour included a belt of 12in. armour amidships, which extended about two-thirds the length of the ship and

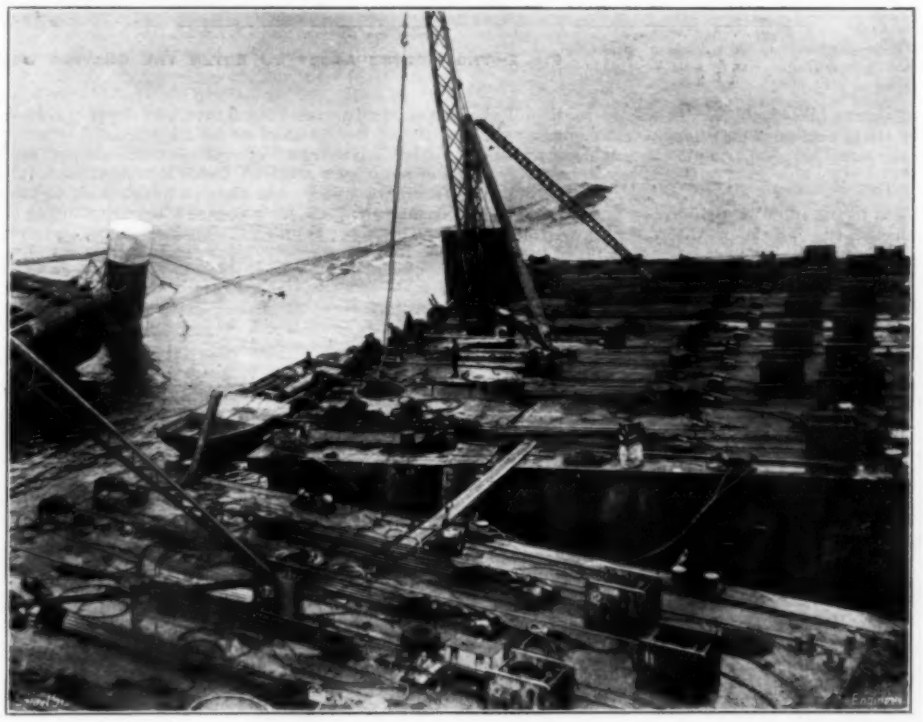


FIG. 1—THE BOW OF THE MOLTKE AWASH WITH LIFTING DOCKS ATTACHED

tapered to 4in. at either end. There were two protected decks amidships, the lower one curved and the upper one flat, to which 3in. armour was fitted. Each of the two funnels had a tapered mantlet of 6in. armour, while 10½in. armour was fitted around the five turret bases and 9in. on the turrets themselves, with 12in. armour at the forward conning tower. There were ten 11in. guns arranged in pairs in each of the five turrets. Two of these were forward and one astern at the centre of the ship, while the two other

SALVING THE EX-GERMAN BATTLE-CRUISER MOLTKE

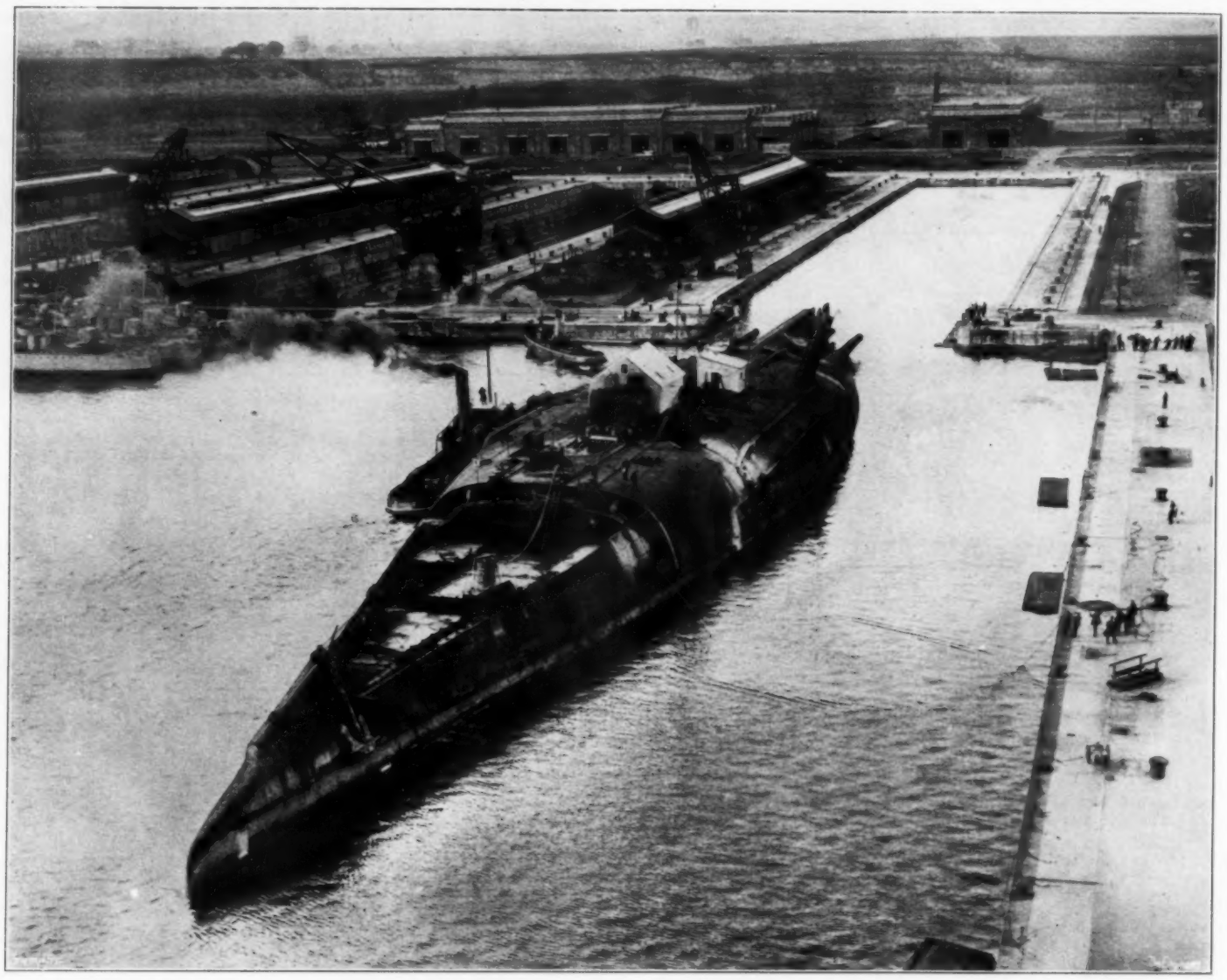


FIG. 2—THE MOLTKE ABOUT TO ENTER THE GRAVING DOCK AT ROSYTH

turrets were placed off centre, one forward and the other aft of the 'midship funnel. Other smaller guns and the usual torpedo armament were also carried.

THE RAISING AND TOWING OPERATIONS.

When in the summer of 1926 Cox and Danks, Ltd., purchased the wreck of the "Moltke" from the British Admiralty, she was lying on a fairly level but slightly soft bottom, about 16½ deg. from being bottom side up in deep water, with a large range of tide and swift currents. The bows of the ship were higher than the stern, and at low tide only a small portion of the hull bottom was visible. In the autumn of 1926 the wreck was examined by divers, and it was found that it was resting on four points, the forward conning tower, the port side of the bridge and crushed superstructure, and No. 3 turret on the port side along with the No. 4 turret aft of 'midships.

The advantages of compressed air as against pumping were evident from the first, and it was decided to render the skin of the ship air-tight, and by increasing the air pressure within the hull to drive out the water through the deck openings and so float the ship sufficiently to allow her to be towed to Lyness Pier for breaking up. The heavy weather of the late autumn of 1926 and the spring of the following year severely handicapped progress, but the work which was started in September, 1926, was steadily continued in the fine intervals, and by October most of the valves in the ship's bottom were closed and concreted up and air pipe connections were made. The crushed foremast and damaged derricks were next cut free by divers, and as far as possible all underwater hindrances which might have prevented the ship from floating were removed.

Unfortunately no drawings were available, such as those which were used to assist in the raising of the "Hindenburg"—see THE ENGINEER of October 1st, 1926—so all that could be done was to pierce the hull and fix an air lock on that portion of the bottom towards the fore part of the ship which was exposed at low tide. It was found on subsequent internal examination that the hull had been entered at a point some 50ft. from the bulkhead of the forward boiler-room. For the purpose of an air lock an old horizontal boiler was employed, which is shown in Fig. 3. The top part of the air lock was sheeted up to prevent spray entering at high water, when the top of the air

FIG. 3—PUMPING COMPRESSED AIR INTO THE HULL

FIG. 4—TOWING THE MOLTKE TO LYNESS

lock was almost awash. Fig. 3 shows the firm's tug, the "Sidonian," pumping air into the wreck. In it may be seen the starboard bilge keel and also a docking keel. In November quantities of air up to 300,000 cubic feet in the twenty-four hours were pumped into the hull, but no appreciable gain was made. Work on removing external parts and recovering a propeller and other detachable gear was successfully continued by means of divers. By working in diving suits inside the ship it was also possible to penetrate through the boiler-rooms and intervening magazine spaces and to locate the two engine-room bulkheads.

It was found that as more and more air was admitted to the hull there was an increased tendency for the bow of the ship to rise and so further to depress the stern, and at the same time to increase the list to port which at one period reached a maximum of 33½ deg. In order to correct the trim and level the ship some method of applying a lifting force to the lower side had to be devised. The means used we describe below.

Throughout the winter of 1926–7 work had been proceeding in Mill Bay beside Lyness Pier reconditioning and strengthening lifting gear on the two floating docks used in the "Hindenburg" pumping operations. A detailed description of one of the docks will be found in THE ENGINEER for September 4th, 1925. Each dock is now provided with electric generating and compressed air plant, and both direct-current and alternating-current supplies are available, the latter being employed for the submersible pumps. The generators include both steam and oil engine units. This plant, together with accommodation for divers, engineers, smiths and joiners, as well as stores for tools and ropes, is arranged in a two-floored structure, once the wall of the original dry dock. Each dock has a width from back to front of 184ft., giving about

FIG. 5—PONTOON HANDLING ARMOUR PLATE

160ft. of free deck, with a depth of 20ft. and a frontage of 114ft. 6in., along which twelve 4ft. diameter cast steel pulleys on 6in. steel shafts are arranged. Over these pulleys there run the 9in. lifting wires, each of which was attached through a twelve-fold pulley block to a 10-ton hand-operated geared winch. Two steam winches were added later, and in the final operations ten hand winches were employed, giving a total lift of about 1200 tons for each dock, the steam winches being retained for special work. The two docks were "pinned down" to the wreck at low tide and the lifting effect of the docks so utilised to trim the ship. At one period in the operations use was made of an additional pontoon and a destroyer hull, which were lashed to the hull on the starboard side, and when filled with water assisted by imparting a further righting moment. Part of the destroyer so arranged will be seen to the right of Fig. 1, which engraving shows the fore part of the ship just above the water level. Attention may be called to the electric cranes at the centre of each dock, which were found to be most useful in lifting parts of machinery and handling the heavy cables.

By the beginning of April, 1927, a second lock was placed in position, and a little later twenty 9in. lifting wires were passed under the ship and attached to the amidships turrets and other strong parts of the ship's deck structures. It was found possible to reduce the water in the boiler-rooms and the engine-room by steadily increasing the air pressure. When making the preliminary lifting tests half the wires were cut on the sharp edges of the turrets and other under-water obstructions. These were immediately replaced, and a further righting effect was obtained by making some side tanks and starboard bunkers air-tight and filling them with water. As the wreck became more level the compressed air was distributed more evenly in the hull and it became necessary to release the pressure at the fore part of the ship through an escape valve.

On June 9th the stern appeared above the water suddenly and revealed a striking marine growth around the propellers. Trimming was further aided by regulating the air pressure in the different compartments, and, finally, the initial list of 16½ deg. was reduced to one of only 2 deg. to 3 deg. About the middle of June arrangements were made to tow the wreck towards the island of Cava, where a temporary anchor had been laid, consisting of an old destroyer hull. It was hoped that a good beaching ground would be found which would enable the ship to be better prepared for the journey to Lyness Pier. However, there was little difference in the depth of water, and it was not possible to gain much by beaching the ship. When towing, one of the middle turret guns fell down and stuck in the soft bottom, and had to be cut free by divers. Unfortunately, the beaching ground which was hoped for was not found, and it was decided to carry out what strengthening operations were possible, as she floated. Towards the end of the summer, the forward part of the ship was closed up and the engine-room after bulkhead was "strong-backed," so that it could withstand both air and water pressure. The central portions of the vessel were also sealed off to the protected deck level, and by inflating with air, and pinning down to docks on either side, it was found possible to get the bottom of the hull 20ft. to 27ft. above water level. In this position the "Moltke" was towed—see Fig. 4—to Lyness Pier, and was beached in 56ft. of water, the upper surface of the hull being about 20ft. above the water at low tide.

SHIPBREAKING OPERATIONS AT LYNESS.

Alongside the beached cruiser there were moored on the shore side the two docks with an intervening pontoon, which gave an unbroken length of nearly 240ft. for handling material. The dock space was served by two 10-ton electric cranes, with long jibs, which could reach over the hull. A standard gauge railway line was laid down the centre of the upturned hull and on this a temporary 3-ton crane was installed for lifting material from the openings made in the skin of the ship.

When, in November last, we paid a visit to Scapa Flow the whole of the boiler-rooms and magazine spaces were open, as well as the forward part of the ship and most of the furnaces, water drums, boiler tubes, and steam drums had been cut up and removed, through 6ft. square openings in the hull. Work was then about to begin on the main turbines and condensers, and the engine-rooms were being opened up. In removing this heavy machinery, Mr. Cox had in mind the possible later raising of the ship in one or more stages, which would enable further material to be recovered. With this in view the size of the openings in the ship's bottom was restricted to 6ft. square, as already mentioned, and all material was cut up so that it could be lifted through these openings. At the side of each opening a steel cover, reinforced with girders, was placed ready for screwing in position. One or more of these covers can be seen in the fore-part of Fig. 2, near to that portion of the keel and forward part of the hull, which has been cut away and again made good with reinforced concrete flooring. To other of the openings air locks have been fitted.

Besides the material taken from the "Moltke," which includes some 3000 tons of scrap, a large amount of heavy armour and gun parts had to be transported from the "Seydlitz" to Lyness. In this work a self-loading pontoon made by the firm, which is shown in Fig. 3, proved very useful. It consisted of a small section of a floating dock, the inside of which was cut away to allow material to be stored. A jib capable of lifting 60 tons was fitted, while end lifting pulleys were arranged, which allowed for lifts of 200 tons being made. Steam-driven winch gear was fitted aboard. In the view reproduced, an armour plate is being handled.

It may be of interest to enumerate the varied classes of scrap metal which are being obtained from the salved vessels. From the "Moltke" alone in the partial dismantling described, over 2000 tons of material have been taken off, which total includes about 1700 tons of steel and wrought and cast iron scrap, 312 tons of non-ferrous metals, and 200 tons of armour. The non-ferrous metals are, of course, the most valuable, and include quantities of copper, brass, manganese bronze, and gun-metal. The armour and the gun steel is valued for its high content of nickel and chromium. It can, we are informed, now be used in conjunction with other material in the making of alloy steels. For convenience in handling, the plates are cut to furnace sizes and we witnessed the cutting of 12in. armour at a speed of 1ft. in 3½ minutes, a cutting pressure of 150 lb. per square inch being used in the oxy-acetylene burner. The boiler plates and tubes are also valuable, as they are low in phosphorus and sulphur, while the nuts and bolts for securing the armour plate have a high nickel content.

TOWING AND DOCKING AT ROSYTH.

After the operations we have described had been carried out it was felt that the removal of further material, particularly the heavy armour and the guns from the underside of the ship, would be rendered more and more difficult as the work proceeded on account of the limited tide range and the inadequate beaching facilities at Lyness. The wreck was therefore sold by Cox and Danks, Ltd., to the Allos Shipbreaking Company, Ltd., at Rosyth Dockyard, and arrangements were made to utilise one of the Admiralty graving docks for the task of breaking up the ship.

The towing arrangements were placed in the hands of the Bugsier Reederei und Bergungs A.G., of Hamburg, which company detailed its three tugs, the "Seefalke," a vessel of 4200 I.H.P. towing capacity, together with two smaller ships, the "Simson" and "Pontos," to carry out the work. As will be seen from the engraving, Fig. 2, provision had been made on the top of the ship for supplies of electric light and compressed air, and a mess-room had been built for the crew which travelled on the "Moltke." The firm's tug, the "Sidonian," which also travelled with the ship to render assistance if required, was fitted out with compressed air plant, which could have been utilised in an emergency. The wreck was towed stern first, stout towing bollards being attached between the bossings for the four propeller shafts.

The somewhat ungainly procession left Scapa Flow on Friday morning, May 18th, and smooth water with a favourable northerly wind prevailed in the Flow; as, however, the tugs and hull passed out into the Pentland Firth through the Cantick Sound, the wreck was caught by the ebb tide, and was carried westward far out of her course. Waves broke over the ship, which rolled as much as 12 deg., spilling air each time she rolled. The next few hours were filled with anxiety, but when the tide turned about 4 p.m., the tugs which had been able to prevent the ship from being carried away, were able to make Duncansby Head and pass into the comparatively smooth water of Moray Firth before the ebb tide again set in. During the week-end the rest of the voyage to the Forth was successfully made, although by loss of air the freeboard was somewhat reduced.

On Monday, May 21st, the Forth Bridge was successfully negotiated and the "Moltke" passed into the outer basin of Rosyth Dockyard, where the tugs left her. Later she was towed into the dock, an operation which is shown in Fig. 2. When docked the underside of the ship was examined by divers, but owing to the unclean water not much progress could be made in packing up the wreck. Finally, it was decided to release the air slowly from within the ship and to allow her to settle down on the dock bottom, after which the water will be pumped out. Work on the breaking up of the hull will then begin at once, and Messrs. Cox and Danks' staff will return to Scapa Flow to proceed with the floating of the cruiser "Seydlitz."

SIXTY YEARS AGO.

IN the late 'sixties authoritative opinion was still sharply divided concerning the relative merits of the broadside warship and the turret warship. Many people were, however, coming round to the view that the turret ship was the preferable type, in that it was less vulnerable than the broadside ship and was capable of carrying heavier guns. In our issue of May 29th, 1868, we printed an account of a proposed development of the turret ship which strikingly illustrated the favour with which the turret principle was regarded by some authorities. The proposal came from Mr. John Elder, of Randolph and Elder, the well-known Clyde engineers, and was contained in a paper which that gentleman had submitted to the United Service Institution. Fantastic though the idea may now appear, its authorship must command our respect. Mr. Elder's vessel was to be a turret ship with everything but the turret omitted! The turret was to be extended in diameter and to be provided with a spherical bottom. It was, in fact, to become a ship resembling in form a saucer with a flat covering. The vessel was to be driven by hydraulic propulsion after the manner of H.M.S. "Waterwitch," the trials of which had recently been concluded with, in the opinion of some, marked success. Mr. Elder stated that a circular ship would draw only about half the depth of water constituting the draught of an ordinary vessel of the same displacement. He anticipated no difficulty in propelling his vessel at a reasonable speed. Model experiments, he said, had convinced him that no more power would be required to drive his vessel at a given speed than was required to propel an ordinary shaped vessel, and he felt assured that he could easily reach 12 knots if indeed the speed did not reach a value commensurate with that of the fastest battleship of the day. By means of an addition to the hydraulic propulsion system the ship was to be made capable of being rotated about its own vertical axis at the rate of one turn per minute. It was to be armed with twenty-six guns, each throwing a 600 lb. solid shot, and it was intended that the guns should be fired in succession at the target as the ship was rotated. The ship, it was stated, would prove remarkably stable and would have a great storage capacity, sufficient, in fact, to carry coal for twenty-five days' consumption. It might be fitted with a high tower carrying a gun which could be used for firing into forts or over high projections. Alternatively, it might be used for carrying one of the several "monster mortars" which had been made, but which no vessel had so far been built to accommodate. Some difficulty was apparently foreseen in connection with the steering of the vessel, but Mr. Elder, we reported, had dealt with this point in his paper and had outlined a somewhat complicated system of steering by means of controlling the direction of discharge of the hydraulic jets. We expressed the opinion that Mr. Elder's proposed vessel might be useful for coast defence, but were inclined to be sceptical regarding the power required to propel it. We did not, we said, attach much importance to the results of model experiments in matters of naval architecture, for from some unexplained cause such results were seldom realised in practice.

Double and Single Head Hole and Expansion-Link Grinding Machines.

THE two grinding machines illustrated herewith and on page 600 include the latest developments made by Beyer, Peacock and Co., Ltd., Manchester, in the construction of grinding machines especially designed for locomotive work. The machines illustrated embody many improvements and labour-saving devices, ball and roller bearings being used wherever practicable, and the gearing being enclosed and running in oil baths.

The double-head machine is designed for grinding out the holes at both ends of locomotive connecting-rods simultaneously, thus ensuring parallelism. It can also be used for grinding the holes in other motion parts and for surface grinding rod jaws, &c. The bed is of robust design. At the rear are brackets carrying the main driving shaft and at each end are reversing gear-boxes, which give the automatic traverse to the grinding heads, two speeds being provided by means of cone pulleys. The work table is furnished with three tee slots, and has a deep trough all round, for draining off the coolant.

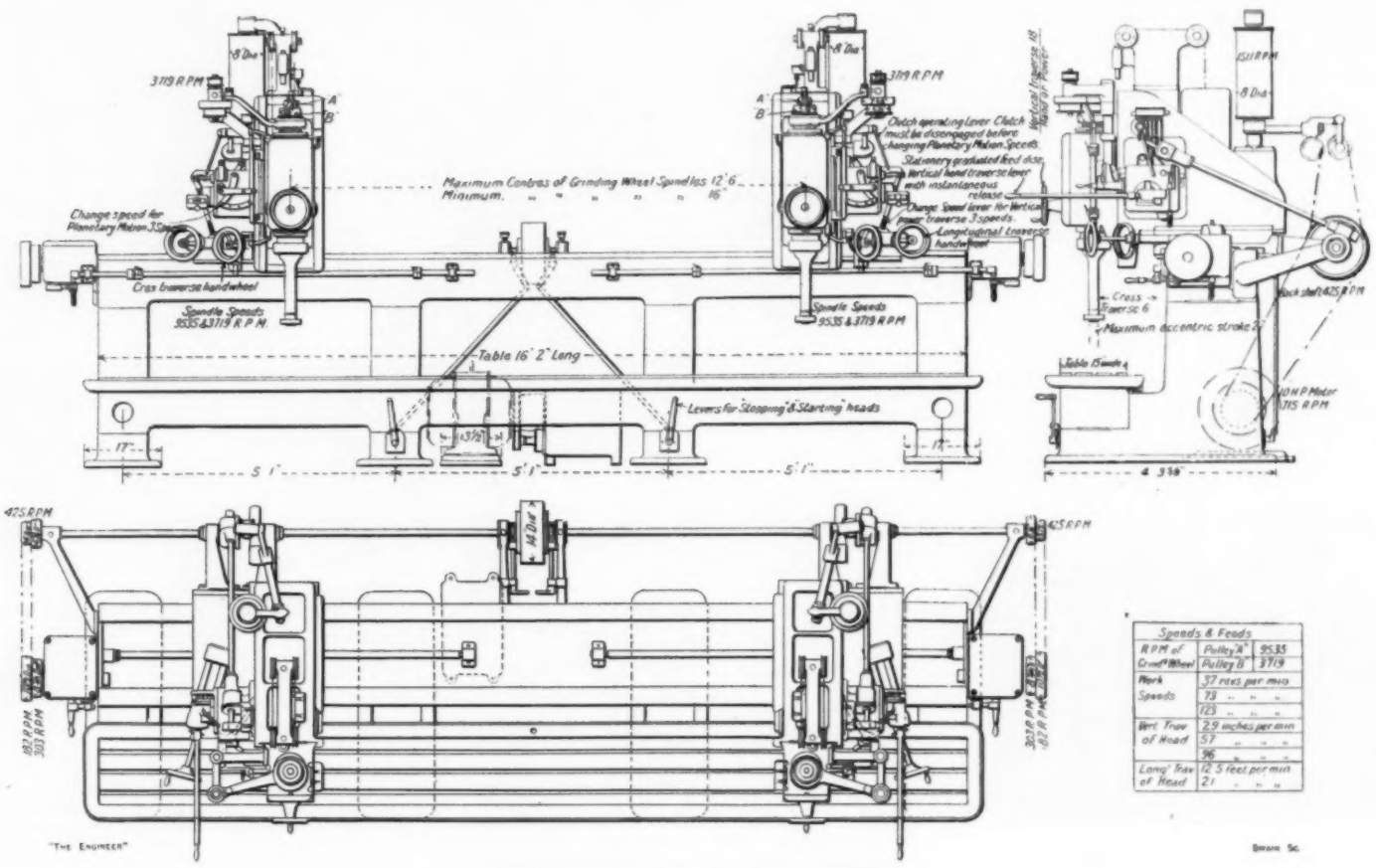
The grinding heads are mounted on slides, and can be traversed longitudinally, either by hand or by power, the transverse movements being brought about by means of hand wheels. The main drives to the heads for the planetary spindles and vertical traverse motions are effected by means of spiral gear drives from the main driving shaft. The planetary motions have three speeds and the vertical traverses have also three rates of automatic traverse. The automatic vertical traverses can be instantaneously released and the grinding heads moved up and down by means of hand levers. The heads, which are well balanced, can be moved with very little effort. The planetary spindles have an excentric stroke of 2in., and the feeds are operated by means of stationary hand wheels, mounted in the front of the spindle casings. A large settling tank for the coolant and a centrifugal pump are provided, the pump being driven by belt from the main shaft.

The following are the leading particulars of the double head machine :—

Length of bed	16ft. 2in.
Size of table surface	16ft. 2in. by 1ft. 3in.
Maximum distance between grinding heads on bed	12ft. 6in.
Minimum distance between grinding heads on bed	1ft. 4in.
Traverse of head on bed (auto.) ..	Up to 5ft. 7in.
Traverse of head transversely ..	6in.
Traverse of spindle vertically	1ft. 6in.
Maximum excentric stroke of spindle	2in.
Number of spindle speeds	Two
Number of work speeds	Three
Number of longitudinal traverse speeds	Two
Number of vertical traverse speeds ..	Three

The machine is designed to grind holes $\frac{3}{4}$in. diameter by 3in. deep and upwards. Its approximate weight is 133 cwt. and the floor space it occupies measures 19ft. 2in. by 6ft. 10in. It requires a 10 B.H.P. motor to operate it.

The single-head machine—Fig. 3—is of similar construction to the tool described above, the grinding heads being identical. The link grinding attachment, which has a standard radius of from 2ft. to 6ft., is mounted on the table and derives its motion from a gear box at the end of the bed. The attachment can be removed and the machine can be used for hole grinding or surfacing in the ordinary manner.


3119 R.P.M.
Maximum Centres of Grinding Wheel Spindles 12'6"
Minimum. " " " " " 10"
Change speed for Planetary Motion 3 Speeds
Cross traverse handwheel
Spindle Speeds 953 & 3119 R.P.M.
Table 16' 2" Long
Levers for Stopping & Starting heads
5' 1"
Clutch operating Lever Clutch must be disengaged before changing Planetary Motion Speeds.
Stationary graduated feed disc.
Vertical hand traverse lever with instantaneous release
Change Speed lever for Vertical power traverse 3 speeds.
Longitudinal traverse handwheel
Cross traverse 6"
Maximum excentric stroke 2"
10 H.P. Motor 715 R.P.M.
4' 3½"
425 R.P.M.
102 R.P.M.
303 R.P.M.
"THE ENGINEER"
Speeds & Feeds
RPM of Grind^g Wheel
Pulley A 953
Pulley B 3119
Work Speeds
37 revs. per min.
73 " " "
123 " " "
Vert. Trav. of Head
2.9 inches per min
5.7 " " "
9.6 " " "
Long^l Trav. of Head
12.5 feet per min
21 " " "

DOUBLE-HEADED HOLE GRINDING MACHINE

Books of Reference.

"DIRECTORY of Paper Makers of Great Britain and Ireland for 1928," published by Marchant, Singer and Co., 47, St. Mary-axe, London, E.C. 3, price 5s. net. This work is now in its fifty-second year, and is too well known for us to do much more than state that the issue for the present year has made its appearance. It contains, as did past issues, lists of :—Paper and millboard manufacturers in Great Britain and Ireland ; paper enamellers, surfacers, varnishers, gummers, embossers, &c., and manufacturers of foil papers, waxed papers, cards, pasteboards, pulpware, &c.; paper makers' representatives ; London wholesale stationers ; mills ; makes of paper, classified ; trade designations—water marks and names ; addresses of firms ; and standard names and sizes of paper. It is, in fact, full of information regarding paper and the paper trade.

"THE Electrical Trades' Directory and Handbook for 1928," which is known universally as "The Big Blue Book," and which is published by Ernest Benn, Ltd., at Bouverie House, 154, Fleet-street, E.C. 4, price 25s. net, is a worthy successor to those which have gone before it. As the present volume forms the forty-sixth consecutive edition of the work, it certainly needs no introduction from us ; the very facts that it has carried on so well and for so long, and has grown so lustily during the process, are sufficient evidence that it fills a really useful purpose. The principal change in the present issue is that that portion of the Handbook Section which was known as the Legal Digest has been replaced by a new feature—a Geographical Section for Great Britain, Scotland and Wales. The whole book has been thoroughly revised, and in all cases in which we have tested it, it has proved to have been brought well up to date. We note that, in the "Classified" Section a considerable number of projecting guide cards has been included in the present book, which should considerably facilitate references in that section.

"THE Year Book of the Scientific and Learned Societies of Great Britain and Ireland," which is published by Charles Griffin and Co., Ltd., of 42, Drury-lane, London, W.C. 2, price 18s., is this year in its forty-fourth annual issue. The present volume furnishes a record of the work done in science, literature and art during the session 1926–1927 by numerous societies and Government institutions. In their preface, the publishers remark :—"That the prosperity of the nation is based on the labour of scientific investigators, whether in the matter of production or health of the producers, hardly needs emphasising to those so engaged, but it cannot yet be said that the fact is recognised generally. It may be that at the present juncture, when, with older industries flagging, new and prosperous ones have been established upon the results of long and patient research, that the nation will be awakened to its indebtedness." At any rate, they, the publishers, do a real service to the community at large in compiling and issuing each year the information which is contained in this useful book of reference.

THE sixteenth edition of Seaton and Rounthwaite's "Marine Engineering Pocket Book," price 15s., was recently published by Charles Griffin and Co., Ltd., of 42, Drury-lane, Lomdon, W.C. 2.—The general contents of the new edition do not differ largely from those of the last edition in 1922, but some changes which have taken place in marine engineering procedure and practice have been noted and are included in the new edition, which has generally been brought up to date. We would suggest that the usefulness of this widely employed book of reference would be still further increased were those sections which deal with propelling machinery and auxiliaries recast and enlarged to take in the far-reaching developments which have recently taken place in marine engineering practice, as applied both to steam and internal combustion machinery.

"THE SHIPPING WORLD YEAR BOOK FOR 1928," which is published by the Shipping World, Ltd., of Effingham House, Arundel-street, Strand, London, W.C. 2, price 25s., appears this year for the forty-second time. The port section of the book, which contains information with regard to ports and harbours throughout the world, has been brought up to date, and a convenient system of entries has been made to enable the description of subports to be found under the heading of the principal port. The tariff section of the year book contains full schedules of the customs tariffs for all the countries of the English-speaking world, embracing the British Empire and the United States. A new feature is the inclusion of a section entitled "Who's Who in the Shipping World," which contains short biographical accounts of the careers of the foremost figures in ship owning, shipbuilding, marine engineering, and the allied industries and professions. There has also been incorporated in this new volume a directory of the world's shipbuilders, boilermakers and marine engineers. The former digest of maritime law has given place to a *résumé* of the principal decisions bearing upon matters of maritime law which have been given in the English Law Courts during 1927. This section should prove of considerable value to all interested in sea transport. The general body of the book has been revised, and there is included an excellent map showing the steamer and railway routes throughout the world. The editor, Mr. Archibald Hurd, would welcome suggestions as to new features or information which might be embodied in the 1929 year book.

FUEL CONFERENCE.

A FUEL Conference is to be held at the Imperial Institute, London, from September 24th to October 6th next. It has been organised as a Sectional Meeting of the World Power Conference by the British National Committee, with the approval of the International Executive Council of the World Power Conference, and will be held under the honorary presidency of the Earl of Balfour and under the presidency of Sir Alfred Mond.

The following have been appointed to form the Conference Commitee :—Dr. E. F. Armstrong ; Mr. C. F. Botley ; Mr. R. A. Chattock ; Sir Dugald Clerk ; Mr. J. Conway Davies ; Mr. D. N. Dunlop (chairman) ; Dr. A. E. Dunstan ; Lieut.-General Sir William Furse ; Major D. Goad ; Sir Robert Hadfield ; Mr. J. Kewley ; Dr. C. H. Lander ; Mr. W. A. Lee ; Dr. H. Levinstein ; Alderman J. H. Lloyd ; Mr. A. K. McCosh ; Mr. H. D. Madden ; Colonel R. K. Morcom ; Mr. W. H. Patchell ; Mr. C. Rodgers ; Engineer Rear-Admiral R. W. Skelton

Mr. R. P. Sloan; Dr. E. W. Smith; Mr. Roger T. Smith; Sir John Snell; Sir David Milne-Watson; and Mr. J. W. Young.

The following have also been appointed to act as a technical Committee:—Mr. A. E. Dunstan; Mr. E. C. Evans; Mr. T. Hardie; Mr. G. A. Hebden; Mr. H. A. Humphrey; Mr. J. Kewley; Dr. C. H. Lander (chairman); Mr. I. Lubbock; Mr. A. K. McCosh; Mr. C. Rodgers; Mr. R. P. Sloan; Mr. Roger T. Smith; and Mr. J. W. Young.

The proceedings will be divided up into the following sections:—A, The Coal Industry—Economic and General Considerations; B, Sampling and Testing of Solid Fuels; C, Coal Treatment—(*a*) Cleaning, (*b*) Drying, (*c*) Briquetting; D, Storage and Handling of Solid Fuels by the User; E, The Oil Industry—Economic and General Considerations; F, Composition, Classification, Preparation, Storage and Handling of Liquid Fuels; G, The Carbonisation Industry—Economic and General Conditions; H, Composition, Classification, Preparation, Storage and Handling of Gaseous Fuels and of the Products of the Carbonisation Industry; J, Utilisation of Fuels for Steam Generation and the Production of Electricity; K, Utilisation of Fuels, including Electricity, for Industrial Furnace Work; L, Utilisation of Fuels, including Electricity, for Domestic Purposes; M, Pulverised Fuel; N, Internal Combustion Engines; O, Transmission of Power; P, Waste Heat Recovery; Q, Low-temperature Carbonisation; R, Peat; S, Power Alcohol; T, Training of Fuel Technicians; V, Organisations Concerned with the Efficient Use of Fuel in Industry; W, Economic Possibilities in the Better Co-ordination of Fuel Utilisation; and X, Technical Data on Fuel.

Inquiries regarding the Conference should be addressed to the secretaries, Fuel Conference, 1928, World Power Conference, 36, Kingsway, London, W.C. 2.

TIN RECLAMATION ON THE CORNISH COAST.

A SCHEME is on foot to reclaim the deposits of tin which are known to exist in the estuaries of certain rivers and streams in Cornwall, especially in that of the Fal. From time immemorial tin mines have been worked within the watersheds of the streams which discharge themselves into the Fal estuary, and the streams, which there join the sea, have for hundreds of years brought down with them in suspension tiny particles of tin which have been deposited in the mud of the estuary. There are millions of tons of this silt in the harbour, and samples which have been taken and submitted to experts for analysis are reported to show that it contains tin in what are declared to be good paying quantities. The proposal is to recover these particles by an elaborate system of dredging and separation, and a start is to be made with a huge bank of mud, some 2 miles in length, which lies in what is known as Mylor Pool. The "tinny" deposits in this bank vary in depth from some 8ft. to about 100ft., and when this tin-bearing mud has been dredged it will be taken ashore for treatment. The tin particles are said to be finer even than the particles in cement, and hitherto they have eluded every process of a mechanical or chemical kind applied to them for the purpose of their recovery. In view, however, of the fact that a start on the scheme of reclamation is apparently to be made, some successful method of treatment would seem to have been evolved. So far, though, no details concerning it have reached us. We understand, however, that experts with wide experience in other parts of the country to whom samples of the Fal tin-bearing mud have been submitted regard the project, which is the first of its exact kind to be undertaken in this country, as most promising. The Duchy of Cornwall owns the foreshores of the Fal, and its permission had to be obtained before the venture could be proceeded with.

B.E.S.A. SPECIFICATIONS.

STANDARD PAINTS AND DRIERS.

THE British Engineering Standards Association has just issued British Standard Specifications for Green Oxide of Chromium, Vandyke Brown, Vermilion, Paste Driers, Liquid Driers, and Red Lakes. The specifications contain clauses regulating the composition, together with standard reception tests for the purchase of these materials; appendices being also incorporated outlining standard methods for carrying out the tests. The issue of these specifications bring the number in this series up to fifty-five, covering paints, varnishes, pigments, oil pastes, extenders, oils, thinners, driers, &c.

The first stage of the work of the Committee is now being brought to a conclusion, but the question of gloss paints is still outstanding. This question is under consideration by a Sub-Committee, and at the present moment research is being carried out with a view to establishing some relationship between physical tests and performance.

Copies of these six new specifications (Nos. 318, 319, 320, 331, 332 and 333) may be obtained from the B.E.S.A. Publications Department, 28, Victoria-street, London, S.W. 1, price 2s. 2d. each post free.

BRITISH EMPIRE SCHOLARSHIPS.—The entrance examinations for the award of British Empire Scholarships in the Faculty of Engineering, Loughborough College have now been completed and awards made. The scholarships are tenable at Loughborough for the full period of the diploma course, and the governors of the College have approved the following awards for 1928:—(1) W. R. Parsons, Devonport High School; (2) C. A. H. C. Ogilvie, Spennymoor Secondary School; (3) A. C. Wesley, Wolverton Secondary School; (4) W. T. Paddock, Cheltenham Grammar School; (5) D. A. Godfrey, Ilkeston Secondary School; (6) G. H. C. Ireland, Royal Military School, Sanawar; (7) V. E. Symons, B.Sc., Rhodes University, South Africa; (8) *aeq.* J. R. E. Taylor, Penarth Secondary School, and G. K. Russell, Loughborough Junior College. These scholarships are open to all British subjects resident in any part of the Empire and are of the value of £75 per annum. Applications were received from a large number of the Public and Secondary Schools in England, South Africa, Malta, Palestine, India and the Federated Malay States.

Provincial Letters.

THE MIDLANDS AND STAFFORDSHIRE.

(*From our own Correspondent.*)

The Whitsuntide Break.

INDUSTRIALLY it has been an easy week in the Midlands and Staffordshire, most of the works having been idle for several days for the Whitsuntide vacation. Iron and steel masters and engineers, in common with many other industrialists, as a result of the cheering and invigorating effects of a holiday in the sunshine, returned to their works at mid-week with vigour renewed and hopes revived. It is really wonderful to notice how their spirits have soared, and there is a determination to force business to to improve if it be at all possible. Almost immediately on the resumption inquiries were set afloat regarding trading prospects, and some manufacturers sent out specifications for considerable tonnages of iron and steel, which they hope to be able to consume between now and August. That buying in much larger volume than of late is anticipated was gathered from conversations with both buyers and sellers in Birmingham this week. The improved competitive position of native material as the result of the increase in foreign iron and steel prices is almost certain to result in an increased number of orders being placed at home, and local producers' prices are such as, to the minds of many industrialists, to justify consumers buying forward. Prospects of lower rates are not good, for it is held that in several branches present selling figures are barely remunerative, and it would be surprising if demand improves, as it is thought it will, if values of home produced material do not advance. Some of the Midland steel works are already well off for orders, that is to say, well off, compared with what they have had on their books for some months past, and in many cases they only took a very short holiday. Ironworks are not so well placed, but the outlook is encouraging. There was a fairly good attendance on 'Change in Birmingham to-day—Thursday—and market conditions showed improvement.

Improving Steel Business.

The position of the Midland steel trade is gradually improving as the result of reduced continental competition. The reduction in imports has of late assumed pleasing proportions, and local steel works now find themselves receiving better specifications, with a marked increase in tonnages ordered. The amended position, however, does not show the steady pressure of demand which it is considered under the circumstances it should. It is understood that delivery of foreign material cannot be obtained under ten or twelve weeks, whereas native producers are able to give prompt delivery. This appears to be the deciding factor in favour of local producers. Unfortunately orders for structural material have become rather slow. The demand for ship plates is not quite maintained, but the lull is believed to be temporary. The heavy founders are doing better in the manufacture of rolls and other mill machinery, while a lot of heavy engineering and castings for railway rolling stock are being turned out. Rollers of bars and strip are making further progress, as some of the foreign interests withdraw from the market and others demand higher prices. Heavy scrap has become dearer, largely on account of the strong demand from South Wales, where mills have very good orders for semi-finished material, required for the manufacture of tin-plate. Sellers are securing as much as £3 7s. 6d. per ton delivered for their stock. Foreign steel prices are very firm and tend to increase, so that competition from this quarter showed decrease rather than otherwise. Prices quoted in Birmingham this week for foreign material were:—Steel bars, £6 17s. 6d. to £7 delivered; No. 3 Belgian iron bars, £6 15s.; foreign billets, £5 15s., with £6 for a rather better quality; joists, £6 1s. 6d. delivered; and angles, £6 14s. 6d. Native steel prices, though they are inclined to harden, have not this week been quotably changed.

Raw Iron Prices.

Immediately prior to the holidays there was a certain amount of liquidation of pig iron stocks at prices well below market levels, but it only applied to one or two firms, and was not resumed when the market reopened after the vacation. Undoubtedly the Midland raw iron industry is passing through a very trying period, and it is quite possible that production will have to be further reduced. Demand continues extremely poor, and it has been impossible for smelters to maintain values at recent levels. It is now possible to obtain Derbyshire No. 3 at £3 2s. 6d. f.o.t., or 1s. per ton less than the figure which has been "held on to" for so many weeks past. Northamptonshire foundry sells at £2 17s. to £2 17s. 6d., very few houses now endeavouring to get the recent level of £2 18s. 6d. The call for forge material is so small that makers have not thought it worth while changing their quotations for this material. There is little doubt, however, but that orders could be placed at below the quoted prices of £2 18s. for Derbyshire and £2 13s. 6d. for Northamptonshire.

Finished Iron.

A fairly steady trade is maintained in the premier branch of the Staffordshire finished iron industry, though order books are not so well furnished as they were a month or so ago. For many special engineering works there is no iron to beat best Staffordshire marked bars, and at £12 per ton they are considered reasonably cheap. Crown bar business still lags, but less is heard of Belgian competition in this branch. Staffordshire and Lancashire makers compete keenly for the available business, each quoting about £10 per ton, but other makers outside the district continue to offer a Crown bar at £9 5s. The call for nut and bolt and fencing iron—quoted at £8 17s. 6d.—is improving as prices become more competitive with those of the foreigner. Some Black Country mills have been buying bars and strip from abroad in 1000 and 2000-ton lots. They are so far impressed by the new situation that they have suspended transactions with the Continent, and are now taking moderate quantities of local iron. There is still a good deal of material to come in on old contracts, and merchants having stocks of foreign iron are making very nice profits on their previous purchases. There has been some falling off in demand for wrought iron tube-strip, but the price is maintained at £11 per ton. Wrought iron scrap is also slower of sale than of late. Germany is still a keen competitor in the tube trade, not only in foreign markets, but in this country, and is offering a larger proportion of finished tubes than formerly.

Sheet Prices Advance.

Galvanised sheets have become dearer. A few weeks ago a strong bearing movement was in progress, and offers of business were received on the basis of £12 17s. 6d., and in some cases £12 15s. The sheet rollers refused, however, to accept business at below £13. A stir in the export market and the increase in foreign steel prices heartened makers to revise their quotations, and they put up the price of 24-gauge corrugated sheets from £13 to £13 5s. Moreover as far as can be ascertained this week, they are adhering to the higher figure, with the result that booking has become decidedly more frequent, and it seems inevitable that substantial orders for sheets will have to be placed. Some local mills are quoting up to £13 7s. 6d., and assert that values will advance still further in the near future. Business on home account has, on account of the holidays, been quiet this week, but some good export orders have been received.

Motor Engineering.

The motor engineering industry in the Midlands is not in the strong position it should be at this season of the year. The year opened hesitatingly, and though business was stimulated by the approach of Easter, it fell off again immediately afterwards, and in few cases were full productive resources called upon. Even the firms which have been most successful in anticipating the requirements of the market and moulding popular predilections are not satisfied with the way things have gone. Though they have made moderately good sales themselves, they realise that the industry as a whole has not been so fortunate and that orders at many of the establishments have been relatively poor. They know that if fairly regular employment has been found for the new plant installed since last year it has been done at the expense of plants which previously existed. In the commercial vehicles department matters have been much better, and here progress has been most marked in the home department. There has been, and still is, a steady demand for light delivery vans, lorries, and heavy six-wheelers. Overseas trade has been patchy. It is a matter of interest that since foreign commercial cars were made liable to duty on admission to the United Kingdom, the home manufacturer has made good use of the freer opportunities he has had for developing this branch of the trade. In four months this year only twenty-three foreign vehicles have been imported, against eighty-seven last year, and 452 in 1926, before the imposition of the duty. The difference in value between this year's imports and those of 1926 is the difference between £5714 and £82,995.

Rolling Stock.

Midland rolling stock establishments continue fortunate in securing new business. Recently, some substantial overseas orders have come to hand. They include a contract for twenty bogie sleeping cars for the Central Argentine Railway awarded the Birmingham Railway Carriage and Wagon Company, Ltd., of Smethwick, twenty-one all-steel bogie third-class carriages for the Nigerian railways, placed with the Metropolitan Carriage Wagon and Finance Company, Limited, of Saltley; and ten bogie sleeping cars for the Rhodesian railways, which are to be built by the Gloucester Railway Carriage and Wagon Company, Ltd. Other rolling stock work is known to be in the offing, and it is confidently anticipated that Midland firms will secure a good amount of it.

Reopening of Great Wyrley Colliery.

The reopening of Great Wyrley Colliery is proceeding steadily. What is known as the yard coal is now being opened out, and it is expected that within the next week or so work will commence in a number of stalls. There are beds of clay under the coal measures, which it is hoped to work, and the clay is reported to be suitable for sanitary ware.

LANCASHIRE.

(*From our own Correspondents.*)

MANCHESTER.

Payment by Results.

LAST week's decision at the Southport Conference of the National Committee of the Amalgamated Engineering Union to recognise systems of payment by results and to approach the employers for the negotiation of a national system of control, whilst in itself an interesting development from the trades union point of view, will not, so far as can be seen at present, have much practical influence on the situation as it now exists in the Manchester area. Inquiries among a number of engineering firms in this district—textile machinists, locomotive builders, and general engineers—show that in the majority of cases a system of payment by results in one form or another is already in operation. Mr. E. D. Simon, of Simon-Carves, Ltd., engineers, of Manchester, made the following interesting comment on the resolution of the A.E.U.: "Payment by results, so long as unfair cutting of prices is avoided, is obviously the most effective method for getting good production on the one hand and fair remuneration for the man who works well on the other hand. In an industry like cotton, where district piece rates are fixed by negotiation and enforced in every mill, the difficulties are very few. In engineering, however, the jobs vary from shop to shop, and even when a job is settled in a shop continual

changes are made in improving the process, so that constant readjustment of piecework prices is inevitable. This makes it very hard to get a system by which the union can protect the rights of a man and prevent unfair cutting of prices simply because a man has worked hard and earned well above the standard rate. In the past there has been a great deal of cutting of this sort by certain employers, which has brought the whole system into disrepute."

Cheaper Current.

Manchester Corporation Electricity Committee has decided to recommend the City Council to authorise various proposed reductions in electricity charges at present levied in the city. It is proposed that the following new scale of traction charges should be set up to operate from April 1st last:—For an annual consumption up to 25,000,000 kWh, 0·875d. per kWh, with reductions of 0·025d. per kWh for each subsequent increase in consumption up to a further 5,000,000 kWh, bringing the charge for a consumption of above 45,000,000 kWh to 0·750d. Reductions are also proposed in respect of street lighting and domestic consumption. In a report on the Electricity Committee's recommendations the Finance Committee points out that the effect for a full year will be to absorb income to the extent of £31,815. The annual estimates for the Electricity Department for the current year were framed on the basis of the revised charges to the extent of £26,437, and the balance will be taken out of the estimated surplus.

Poor Home Market for Textile Plant.

Speaking at the annual meeting of Tweedales and Smalley, Ltd., textile machinery manufacturers, of Rochdale, Mr. W. Davidson, the chairman, referring to the home trade in textile machinery, said stagnation continued to prevail so far as trade in Lancashire was concerned, for during the past twelve months the company had received very little business from that direction. Discussing the question of trade in textile machinery with the Russian market, Mr. Davidson said that, speaking from actual experience, their contracts with Russia were working out very satisfactorily. The company's experience of their Russian customers was that they were most exact in their finance and very punctual in making their payments.

Mersey Docks Appointment.

Major Thomas L. Norfolk, who has been in the service of the Mersey Docks and Harbour Board since 1914, after serving as dock engineer to the North-Eastern Railway Company, has been appointed chief engineer to the Mersey Board, in succession to Mr. T. M. Newell, who is about to retire from that position.

Non-ferrous Metals.

In the non-ferrous metal market during the past week copper has shown a further substantial improvement in values, and is closing the month at a high level. Refined descriptions of the metal, in particular, have been prominent in this respect, and a sharp advance has been registered, with buying interest, allowing for holiday influences this week, steadier than it has been of late. The cause of the continued firmness in this section lies, of course, in the fact that producers of the metal in America are now in a much stronger position, and are exerting to the full the "bullish" possibilities of the situation. There have been no violent movements in the tin market since my last report, but, judging from the slight ups and downs that have occurred, the price position is far from stable. Values recovered a little towards the end of last week after earlier losses, but the opening sessions this week witnessed fresh reaction and quotations at the time of writing are only fractionally above the levels of a week ago after the heavy decline then recorded. The demand for the metal from consuming interests has been relatively slow and speculative buying has not been pronounced. In the case of lead prices, after about a month of marked steadiness, have firmed up to a relatively important extent, being at about 15s. to £1 a ton higher than a week ago, and bringing quotations to the top figure since the end of January. There has been a quiet demand for spelter and prices are about maintained on balance.

Iron.

Business in pig iron and in manufactured descriptions, as well as in steel, has been virtually at a standstill this week, and transactions have been well below even the unsatisfactory level that has been ruling of late. With holiday interruption of operations at many of the consuming centres in Lancashire, buyers are deferring the placing of fresh orders until more or less normal conditions return. There is no evidence of anything resembling strength about the market for foundry iron, for the Midland varieties, at all events, and further slight concessions have been made by sellers since my last report. Derbyshire producers this week have been asking no more than 71s. per ton, delivered Manchester or equal distance, even for small parcels, and the probability is that this figure will be cut in the event of any big weight of business being offered. Quotations for Staffordshire brands also are in the neighbourhood of this level. Middlesbrough makers continue to quote 79s. per ton for delivery to Lancashire users, and Scottish at from 87s. 6d. to 90s., according to brand, with hematite obtainable at about 83s. per ton, also delivered. Inquiry for manufactured iron this week has been very poor, but Lancashire makers are still asking £10 per ton for Crown bars and £9 10s. for seconds.

Steel.

Steel buying from all directions has been exceptionally inactive, although a return to the day-to-day scale of operations may be looked for within the next week or two. As to an early improvement beyond this point, so far as this market is concerned, rollers seem to be by no means hopeful. Meanwhile, quotations for home-manufactured steel products are steady all round, small bars being offered by re-rollers at from £7 10s. up to £7 15s. per ton, with large diameter bars at £8 17s. 6d., joists and sections at £7 17s. 6d., tank plates at £8 12s. 6d., and boiler plates at about £9 15s. per ton for basic qualities and 5s. per ton extra for acid materials. The Indian demand of late for galvanised sheets has been poor, but makers have stiffened quotations a little, 24 gauges for the usual Bombay and Calcutta markets being at £13 5s. per ton f.o.b. Business in imported steel materials remains inactive, but firmness in this section continues, billets for delivery to Lancashire works being quoted at up to £5 12s. 6d. per ton, sheet bars at £5 14s., Siemens plates at £8 to £8 2s. 6d., wire rods at about £6 15s., joists at £6 to £6 2s. 6d., and angles at £6 15s.

BARROW-IN-FURNESS.

Hematite.

There is not much life in the pig iron market this week, but production continues despite the fact that the demands on steel account at present are nil. The furnaces at Barrow are engaged on special quality iron. At other works there is a tendency for stocks to accumulate, but not to a great extent. Home business is moderate, the Midlands being the best customers. There have been shipments from Barrow to North Wales and the Continent. Exports to the latter, though not heavy, are becoming fairly regular. American business is quiet. Iron ore continues to be fair, and there is a certain amount leaving the district, but there is room for improvement in this side of business. The Anticross mines at Dalton have been closed down, owing to water difficulties, and as the pumps have been removed, the prospects of re-opening are remote. The steel trade is quiet. Orders are difficult to obtain, and at present the only departments engaged are the hoop mills at Barrow, which are assured of a steady run. Orders are held for rails, but they are not sufficiently large to merit the re-starting of the mills, which have now been thoroughly overhauled.

SHEFFIELD.

(From our own Correspondent.)

Depression in Heavy Steel.

A STATE of depression still characterises most of the branches of the local steel trade, and this is especially true of the heavy side, which produces steel of ordinary qualities. Owing to scarcity of orders and lack of inquiry for basic steel, several large furnaces, as well as portions of manufacturing plant, have been shut down. For some weeks past the demand for open-hearth steel has not been much more than equal to half the capacity of the works, although it has been above the pre-war level. At the same time there are indications that the tide is turning. The markets for scrap and raw materials show an improved tone, and there is a disposition on the part of consumers to place forward orders, which has not been manifested for some considerable time. This alteration is due to the situation on the Continent, where prices continue to rise. It is believed that the higher rates are not merely temporary, and that the demand for British-made basic steel is likely to expand. No doubt foreign competition will continue, but it will be in a milder form, and will not necessitate that severe price-cutting which has caused firms here to take trade at little or no profit.

A Better Year.

The annual report for the Park Gate Iron and Steel Company, Ltd., for the year ended March last is encouraging. For several years the firm has had a large deficit, and 1926, with its coal strike, caused a loss of £32,789. For the past year there was a profit of £40,064. The directors state that the works were in continuous operation throughout the year, and the output of both pig iron and steel was the highest in the history of the company. In September last the company decided to support the rebate scheme formulated by the steel association. Although the association has been effective in maintaining prices for certain classes of steel, a large portion of the company's output is outside its control, and unfortunately the prices of the uncontrolled materials have steadily fallen. This fall has been met to some extent by economies in working. The report also mentions that the first section of the new battery of gas machines for the open-hearth furnaces is now at work with satisfactory results. A new slag-breaking plant is being installed to deal with larger quantities of blast-furnace slag.

A Departmental Review.

It is still in the special branches of its steel manufacture that Sheffield is doing best. The call for stainless and rustless steels continues to grow as new varieties are developed and new uses are found for them. The motor and cycle trades are good customers of the city, although their aggregate requirements do not yet equal those of recent years. The *Journal* of the Sheffield Chamber of Commerce reports that "the home demand for structural steel is good and growing, but ship steel is falling off, and railway steel has been quiet, but is looking up once more. Local firms are negotiating some big contracts for railway materials, on Indian, African, and South American accounts." Employment in the light castings industry is not good, although conditions in this locality are better than those reported from Scotland. There is a moderate amount of activity in the departments making engineers' tools and hacksaws, but shortage of work is characteristic of the edge tool and building tools sections. The demand for garden tools shows a falling off. There is nothing new to say about the cutlery and plate departments, which are, in the main, in an unsatisfactory state. A number of substantial contracts are on hand for steamship equipments, but apart from them the demand for best plate is very poor.

Sheffield Steel for American Blades.

Sheffield continues to do a large trade in safety razors, and also in supplying the material from which such articles are manufactured. Last week the quality of the city's blanks was seriously impugned at the inquiry into the application of the Sheffield Cutlery Manufacturers' Association for a compulsory order for the marking of all imported cutlery. Mr. C. Nevinson, managing director of Souplex, Ltd., Morecambe, safety razor blade manufacturers—who opposed the application—stated that no blanks of adequate quality could be obtained in Sheffield or any other part of the British Isles. He agreed that he had received samples and quotations from a Sheffield firm which offers blanks for sale to the trade, but said he had not placed an order because the samples were "rubbish." A tribute to Sheffield of a very different kind comes from a Mr. Squire, of Hampstead, who, writing to *The Times*, states that all the Gillette safety blades imported into this country for use by the British public have first been manufactured from Sheffield steel in Sheffield. The only process of manufacture done outside this country, he says, is to place the cutting edge on the blanks that are imported. The Gillette company manufactures for world consumption from Sheffield steel blanks of blades over seven times the quantity required for use in this country. Moreover, the Gillette company is probably a larger buyer of British crucible steel than the whole of its competitors.

Derbyshire Pithead Baths.

A scheme has been set on foot for the erection of pithead baths at Grassmoor Colliery, near Chesterfield, which will be the first in Derbyshire. They are to cost £15,000, and are to include an installation of what is known as Alpine sun rays. The colliery company has promised to provide the necessary site, with electric light and current, water and coke required for the heating of the boilers, free of charge. The Miners' Welfare Committee will defray the cost of the erection of the baths, and the miners, of whom about 1800 are employed at the collieries, have agreed to contribute 2d. per week each to defray the expenses of maintenance.

Success of New Plant.

A tale of progress was told at the annual meeting of the Chesterfield Tube Company, which was able to pay a dividend of 6 per cent. for the past year as compared with no distribution for the previous twelve months. The chairman said that the policy of improving and modifying plant had been continued, and they had carried out and paid for out of revenue last year several important modifications which had been very beneficial. They had installed in some of their departments new and up-to-date plant which had been almost abnormally successful, and in one or two instances the cost of the fairly expensive plant installed had been recovered after a few months' actual work. With regard to the future, he said that, provided they were not handicapped by industrial troubles, it looked very hopeful indeed. The actual total orders on hand were sufficient to keep the works going for some months.

Selby Shipbuilding.

Two vessels were launched last week at the Ouse shipbuilding yard of Messrs. Cochrane and Sons. One was a yacht for an Isle of Man gentleman, which has a length of 138ft. 4in. between perpendiculars, with 24ft. beam and 14ft. depth moulded. The hull is built on trawler lines, so that at the end of her service as a yacht it will be feasible to convert her into a trawler. The second vessel was a trawler for the Icelandic fishing area, built for the West Dock Steam Fishing Company, of Hull. She is 138ft. 4in. long and of the latest type. Messrs. C. D. Holmes and Co., of Hull, will fit the machinery.

Hull Municipal Telephones.

The municipal telephone system of Hull is being gradually converted to an automatic installation. Two additional automatic exchanges were opened last week, making five in all, and it is expected that, in another year or two, the conversion will be complete. The two new exchanges will cost about £30,000, which will be met out of the reserve funds. The Hull telephone service is the cheapest in England. Alderman Ombler, speaking at a luncheon after the exchanges had been visited, predicted that last year's working would show a profit of £10,000 or £11,000, and expressed the hope that in another year or two they would be in a position to lower the tariff.

NORTH OF ENGLAND.

(From our own Correspondent.)

New Tees-side Industry.

A NEW industry—the manufacture of homogeneous lead linings—is to be established at Stockton-on-Tees. This development will not only be fresh to the North-East Coast, but the first of its kind in England, for at the moment it is only operated by a patented secret process in Germany. Ashmore, Benson, Pease and Co., of Stockton, however, recently bought the patent from the German owners, and are now making arrangements to operate it at the works of T. Sudron and Co., Stockton, which they purchased at the end of last year. Homogeneous lead lining is to be made by plant to be installed in a building, which will shortly be put up. The application of this lead lining is chiefly found in the chemical industry. The Synthetic Ammonia and Nitrates Company, of Billingham-on-Tees, with which Ashmore, Benson, Pease and Co. are linked up, will take a great deal of the output at first, and it is anticipated that the industry will, when in full swing, find employment for a substantial number of workmen.

Cleveland Iron Trade.

Values of Cleveland pig iron are steady and inquiries are expanding, but notwithstanding advances in foreign products and reports that producers abroad have sold so heavily over the next few months, that they are not seeking further orders, transactions here keep on a disappointing scale. The outlook generally is regarded as rather more encouraging, but customers are still back-

ward. The strong and still improving statistical state of industry enables makers to resist any tendency to a weakening in values. Stocks are at a very low ebb, and the output is disposed of fairly well ahead, largely for consumption at makers' own works, though local and other home buyers are taking up fair quantities, and deliveries to Scotland are still going steadily forward. After provision to meet these requirements has been made very little iron is available for sale in the open market, and expansion of the present light overseas demand would speedily necessitate an enlargement of production. No. 1 Cleveland foundry iron is firm at 68s. 6d.; No. 3 G.M.B., 66s.; No. 4 foundry, 65s.; and No. 4 forge, 64s. 6d.

Hematite Pig Iron.

Producers of East Coast hematite pig iron are endeavouring to take a rather firmer stand, and they report further small sales to Sheffield and other home areas, as well as to foreign destinations, but they are hampered by rather heavy, and still steadily increasing stocks, and the outlook is far from bright. Quotations keep well below the cost of production. Prices are not definitely fixed, and it is difficult to ascertain on what terms contracts can be arranged. Nominally market rates keep on the basis of 70s. for mixed numbers, but substantially less is understood to have been accepted.

Ironmaking Materials.

There is no new feature in the foreign ore trade. Threatened scarcity maintains prices, though sales are little heard of. Best Rubio ore is 22s. 6d. per ton c.i.f. Tees. Coke is, if anything, a little stiffer, due to export sales. Ironmasters, however, are still buying sparingly, and Durham good average blast-furnace qualities keep at 17s. 6d. to 17s. 9d. per ton delivered at the works.

Manufactured Iron and Steel.

Manufactured iron and steel quotations are unaltered. New business matures slowly, but with prices of several commodities competitive with values of foreign products, expansion of trade is looked for. Growing scarcity of continental semi-finished steel is a welcome phase which encourages hope of an enlargement of demand.

Reduction of Furnaces in Blast.

The number of blast-furnaces in operation on the North-East Coast has been reduced this week from thirty-eight to thirty-seven, as the result of the Linthorpe and Dinsdale Smelting Company blowing out one of the Dinsdale furnaces. This furnace had been manufacturing spiegel.

The Coal Trade.

Operations in the Northern coal trade have been interrupted through the Whitsuntide holidays, and business has been largely confined to small cargoes required for immediate delivery, but at least one good order has come forward. The Oslo Gasworks have negotiated through merchants for 45,000 tons of best Durham gas coals for shipment over twelve months beginning in July on the basis of 14s. 7½d. per ton f.o.b. The undertaking invited tenders for three different quantities—10,000 tons, 30,000 tons, and 35,000 tons; and 45,000 tons to be delivered over stated periods. The greatest quantity has therefore been taken. The Berlin Gasworks are in negotiation for a large quantity of Durham coking coal, and the prices mentioned as having been tendered are in the region of current values. In conjunction with this possible business there are inquiries for tonnage for over next year. The outlook is still uncertain. The general inquiry has fallen away, but it may come again. Colliery positions vary a good deal. In Northumberland some of the pits producing best steams are well circumstanced, but indifferently placed for trade in smalls. Best steams through second-hands are down to 13s., but direct from 13s. 3d. to 13s. 6d. is named. In the Durham gas section there are weak spots for some of the best kinds, while secondary sorts of certain brands are booked well into June. In another connection coking coals are in active inquiry, and bunker coals are steady and in better demand. The market for gas coke shows a strong tone, and buyers are only held in check by the higher prices asked. Prompt prices are firm at 20s. to 21s., and 22s. forward. Patent oven cokes are steady at 17s. 6d. to 18s., and special makes at 23s. to 27s.

SCOTLAND.

(From our own Correspondent.)

Sugar Refining at Cupar, Fifeshire.

SUGAR refining has begun at Prestonhall, Cupar, Fifeshire, in a factory belonging to the Second Anglo-Scottish Beet Sugar Corporation. This is the first factory to employ the Weise system. The capacity of the factory is round about 250 tons per day, but in the meantime about half that quantity will be dealt with. Upwards of 3000 tons of raw sugar are on hand, and cargoes are on the way from San Domingo.

Coal Distillation.

The Bussey Coal Distillation Company, Ltd., an American syndicate, will erect works at Glenboig, near Glasgow, for the purpose of distilling coal, and selling oils and other by-products. It is anticipated that inward and outward traffic from the new works will reach 1000 tons per day. A site of 20 acres has been acquired north of Glenboig railway station. At present the chief industry of Glenboig is firebrick manufacture.

Locomotive Contracts.

It is announced that William Beardmore and Co., Ltd., Dalmuir, have received a contract from the London, Midland and Scottish Railway for sixty-five side-tank six-coupled 0–6–0 type locomotives, having wheels 4ft. 8in. diameter, cylinders 18in. by 26in. stroke, and a boiler pressure of 180 lb. per square inch. This contract follows one of a similar nature for twenty-five locomotives for the same railway company. In addition to the above, Messrs. Beardmore are to supply Beardmore-Caprotti valve gear for nine four-cylinder locomotives, the alteration to be carried out at Crewe. Similar valve gear to the extent of twenty-one sets will be supplied for two-cylinder engines on the Bengal-Nagpur Railway, India, and a number of sets for four-cylinder engines on the Bengal-North-Western Railway. The London and North-Eastern Railway has also ordered several sets for four-cylinder engines.

Steel.

The output from the steel works continues on restricted lines, and on the whole demands are still far below expectation, especially for plates and sections. There are rumours of a change in prices, particularly for export. Black steel sheets are not busy, especially the heavier gauges. Galvanised corrugated sheets, however, have stiffened to £13 5s. per ton f.o.b. for 24 g.

Iron.

Bar iron is poorly supported, and though the re-rolled steel departments have a fairly steady turnover, this does not by any means compensate for the slackness in the former. Home prices are unchanged, and while export quotations are keen in comparison with home prices, orders remain few and far between.

Pig Iron.

On the whole, consumers of pig iron continue to buy on a hand-to-mouth principle, and the regular volume of business in the market is very small. Prices are unchanged.

Scrap.

The volume of business is moderate, and prices are fairly steady at 65s. per ton for heavy steel and cast iron.

Exports and Imports.

Arrivals in the Clyde during the past week included 6000 tons of iron ore, 4100 tons of steel and iron from Wales and the Continent, and 2550 tons of pyrites from Huelva. Shipments of steel and iron included 4100 tons of various products despatched to the Colonies, China, South America and the Persian Gulf. Pig iron shipments amounted to 653 tons. It was also reported that a cargo of zinc concentrates amounting to 2600 tons was discharged at Greenock.

Coal.

Owing to the seasonal decline in demand and the reluctance of exporters to deal otherwise than for immediate shipments, the collieries' scheme to alleviate the depression in the industry has not been fully successful. Drastic reductions of output have already taken place, and it is now suggested that collieries raising house coal should be allowed to close for three months, instead of the minimum six months' period allowed under the scheme. Meanwhile there is little change in the market. Lanarkshire splints and ells having a steady demand, maintain a firm standard. Fifeshire steams also are steady, but first qualities can on occasion be obtained slightly under colliery prices through second-hands. Lothians steams are steady, owing to decreased outputs. Washed materials are irregular. Treble and double nuts are fairly busy, but smaller sizes are not so well off. Aggregate shipments last week amounted to 272,268 tons, against 206,385 tons in the preceding week and 219,864 tons in the same week last year.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

Coal Trade Conditions.

OPERATIONS have been brought to practically a standstill as the result of the holidays, and it will be next week before the conditions become anything like settled. It is difficult to say with any certainty what the prospects are, though the loss of three days' output this week should have some steadying effect, notwithstanding the apparent paucity of new business. Last week finished up very disappointingly. There was no pre-holiday rush for supplies. The conditions were, in fact, very quiet, and on Saturday morning there were as many as forty-eight idle tipping appliances at the various docks, which in itself shows that many collieries must have been in anything but a favourable position owing to the shortage of tonnage into which to ship their coals. It is therefore not surprising to find that for the week ending the 25th inst., shipments only amounted to just over 415,000 tons, as against rather more than 422,000 tons for the previous week. There was no work at the docks on Monday and Tuesday of this week, but there should have been a fair supply of tonnage in dock to enable the collieries to make a fair start on Wednesday as the result of steamers docking over the holidays, and furthermore chartering last week marked a considerable improvement upon the amount of tonnage which has been taken up for some time. In fact, the total was over 390,000 tons, which is the highest figure since the week ending April 21st. Quite recently chartering of tonnage for South American destinations was adversely affected by strike troubles at the discharging ports, and fears of its extension, but news was received last week that the strike had terminated and that led at once to the taking up of tonnage to load outward cargoes of coal from this district. Not only has business for current loading been quiet, but operations for supplies for delivery over a period have displayed no special activity. The Sao Paulo Railway of Brazil is reported to have contracted with a Cardiff firm for 50,000 tons of large coal to be delivered from August to March next, and there is an inquiry on Belgian account for 25,000 tons to 30,000 tons of beans, peas and duff for shipment over twelve months from July next.

Anthracite Developments.

There has naturally been some speculation as to whether the tragic death of Lord Buckland is likely to have any effect upon the course of events concerning the provisional agreement which was entered into on Monday of last week, by which the Amalgamated Anthracite Collieries, Ltd., acquire the colliery properties of the Vale of Neath and Gwaun-cae-Gurwen undertakings. This provisional agreement was signed by Sir Alfred Mond and Mr. F. A. Szarvasy on behalf of the Amalgamated Company, and a statement has been made that the death of Lord Buckland will not affect the position in the least, and that all that remains to be done is for the provisional agreement to receive the confirmation of the shareholders in the Amalgamated Company. Reports have also been current during the past week of other developments in the anthracite section of the coalfield. It is understood that a company with a strong backing is being formed to develop and work certain seams which have lately been taken over. An annual output of a quarter of a million tons is aimed at, and the basis of capitalisation will represent 12s. 6d. per ton on the output.

Coals for Spain.

Ever since the Spanish Government introduced its restrictive regulations upon the shipment of British coals to Spain in order to assist the native industry, reports have been current of still further developments calculated to be harmful to the coal export trade of this country, and of South Wales in particular. It has been reported that the Spanish Government intended to create a monopoly in the matter of the purchase and distribution of British coal in Spain, but according to a letter received from the Spanish Ambassador in London that statement is described as fantastical, and that such a plan has not even been considered by the respective competent authorities in Spain.

Tin-plate and Steel Works.

Quite recently several new tin-plate mills have been put into operation in the Swansea area, and it is stated that the construction of other mills is under consideration. The Ebbw Vale Works *Magazine* is also interesting for its review of the trade conditions in that area. In this it is stated that the slight improvement in trade has continued, and with the exception of the customary stoppage for the Easter holidays work has been continuous during the period under review. In the steel and iron departments the Siemens furnaces which were closed down in April, 1925, have been restarted. The first furnace was put into operation on March 26th, the second on April 2nd, and the third on May 9th last. Work is being pressed forward in connection with the additional battery of by-product ovens which is to be brought into operation, and it is hoped that this plant will be fully occupied during the course of the next few weeks. In the colliery department preparatory work for the reopening of the Prince of Wales Colliery is in progress.

Current Business.

Business last week was for the most part confined to small parcels of coal required for the finishing off of cargoes which exporters were anxious to get away before the holidays. There was certainly very little being done in respect of coals for shipment after the vacation, but still colliery salesmen were not apparently perturbed in view of their commitments and of the fact that their supplies would be severely curtailed as the result of the three days' suspension of production. Nominally there was no change in market prices, and salesmen adhered at least to the minimum figures in operation, if they could not do better. This week the conditions are extremely quiet, there being no favourable development in the demand. It will be next week before the conditions become settled.

PERSONAL AND BUSINESS ANNOUNCEMENTS.

ALFRED HERBERT, Ltd., of Coventry, asks us to announce that its telegraphic address is "Lathe, Coventry," and not "Lathes, Coventry," as previously stated.

THOMAS RYDER AND SON, Ltd., of Turner Bridge Works, Bolton, ask us to announce that they have been appointed sole agents for Great Britain for the range of "Phœnix" multiple drilling and other special machines made by Messrs. Habersang and Zinzen, of Dusseldorf-Oberbilk.

THE GENERAL ELECTRIC COMPANY, Ltd., asks us to announce that the telegraphic address of its Glasgow branch has been changed from "Apparatus" to "Electricity," and that of its Aberdeen branch from "Relay" to "Electricity." These changes will take effect from June 1st.

LAUNCHES AND TRIAL TRIPS.

ADELA, twin screw oil tanker; built by Sir W. G. Armstrong, Whitworth and Co., Ltd., to the order of Anglo-Saxon Petroleum Company, Ltd.; dimensions, length, 305ft.; breadth, 50ft.; depth, 15ft.; to carry 2300 tons. Engines, direct acting, triple-expansion, 13in., 22in. and 35in. by 24in. stroke, pressure 180 lb. per square inch; launch, May 21st.

TACTICIAN, single-screw cargo vessel; built by Cammell Laird and Co., Ltd., to the order of Charente Steamship Company, Ltd.; dimensions, length, 415ft. 3in.; breadth, 54ft. 3¼in.; depth, 32ft. 7in. Engines, triple-expansion, 27in., 46in. and 77in. by 54in. stroke, pressure 210 lb. per square inch; launch, May 22nd.

HINDPOOL, steamer; built by Wm. Gray and Co., Ltd.; to the order of Rod Shipping Company, Ltd.; dimensions, length, 418ft.; breadth, 53ft. 6in.; depth, 29ft. 5¼in. Engines, triple-expansion, 26in., 43in. and 71in. diameter by 48in. stroke, pressure 180 lb. per square inch; constructed by Central Marine Engine Works; trial trip, May 23rd.

Current Prices for Metals and Fuels.

IRON ORE.

N.W. COAST—	
(1) Native	19/- to 21/-
(1) Spanish	19/- to 21/-
(1) N. African	19/- to 21/-
N.E. COAST—	
Native	18/- to 21/-
Foreign (c.i.f.)	22/6

PIG IRON.

	Home. £ s. d	Export £ s. d.
(2) SCOTLAND—		
Hematite	3 14 0	—
No. 1 Foundry	3 15 0 to 3 16 0	—
No. 3 Foundry	3 10 0 to 3 11 0	—
N.E. COAST—		
Hematite Mixed Nos.	3 10 0	3 10 0
No. 1	3 10 6	3 10 6
Cleveland—		
No. 1	3 8 6	3 8 6
Silicious Iron	3 8 6	3 8 6
No. 3 G.M.B.	3 6 0	3 6 0
No. 4 Foundry	3 5 0	3 5 0
No. 4 Forge	3 4 6	3 4 6
Mottled	3 4 0	3 4 0
White	3 4 0	3 4 0
MIDLANDS—		
(3) Staffs.—		
All-mine (Cold Blast)	—	—
North Staffs. Forge	—	—
,, ,, Foundry	3 2 6	—
(3) Northampton—		
Foundry No. 3	2 17 0 to 2 17 6	—
Forge	2 13 6	—
(3) Derbyshire—		
No. 3 Foundry	3 2 6 to 3 3 6	—
Forge	2 19 0	—
(3) Lincolnshire—		
No. 3 Foundry	3 2 0	—
No. 4 Forge	3 0 0	—
Basic	3 0 0	—
(4) N.W. COAST— N. Lancs. and Cum.—		
Hematite Mixed Nos.	4 2 0 (a) / 4 5 0 (b) / 4 8 6 (c)	—

MANUFACTURED IRON.

	Home. £ s. d.	Export. £ s. d.
SCOTLAND—		
Crown Bars	10 5 0	9 15 0
Best	—	—
N.E. COAST—		
Iron Rivets	11 5 0	—
Common Bars	10 5 0	—
Best Bars	10 15 0	—
LANCS.—		
Crown Bars	10 0 0	—
Second Quality Bars	9 10 0	—
Hoops	13 0 0	—
S. YORKS.—		
Crown Bars	10 10 0	—
Best Bars	11 0 0	—
Hoops	11 10 0 to 12 0 0	—
MIDLANDS—		
Crown Bars	9 5 0 to 10 0 0	—
Marked Bars (Staffs.)	12 0 0	—
Nut and Bolt Bars	8 17 6 to 9 0 0	—
Gas Tube Strip	11 0 0	—

STEEL. (d)

	(6) Home. £ s. d.	(7) Export. £ s. d.
(5) SCOTLAND—		
Boiler Plates	10 10 0	10 10 0
Ship Plates, ¼in. and up	8 7 6	7 12 6
Sections	7 17 6	7 2 6
Steel Sheets, ¼in.	8 12 6	8 10 0
Sheets (Gal. Cor. 24 B.G.)	13 5 0	13 5 0

STEEL (*continued*).

	Home. £ s. d.	Export. £ s. d.
N.E. COAST—		
Ship Plates	8 7 6	—
Angles	7 17 6	—
Boiler Plates	12 15 0	—
Joists	7 17 6	—
Heavy Rails	8 10 0	—
Fish-plates	12 0 0	—
Channels	10 5 0	£9 to £9 5
Hard Billets	7 12 6	—
Soft Billets	6 15 0	—
N.W. COAST—		
BARROW—		
Heavy Rails	8 5 0	—
Light Rails	8 10 0 to 8 15 0	—
Billets	7 10 0 to 10 0 0	—
MANCHESTER—		
Bars (Round)	8 17 6	—
,, (Small Round)	7 12 6	—
Hoops (Baling)	10 5 0	10 0 0
,, (Soft Steel)	9 0 0	8 15 0
Plates	8 12 6	—
,, (Lancs. Boiler)	10 0 0	—
SHEFFIELD—		
Siemens Acid Billets	10 0 0	—
Hard Basic	7 2 6 to 7 12 6	—
Intermediate Basic	7 0 0	—
Soft Basic	6 5 0 to 6 7 6	—
Hoops	9 10 0 to 10 0 0	—
Soft Wire Rods	7 10 0	—
MIDLANDS—		
Small Rolled Bars	7 7 6 to 8 0 0	—
Billets and Sheet Bars	5 15 0 to 6 0 0	—
Sheets (20 W.G.)	11 10 0 to 12 0 0	—
Galv. Sheets, f.o.b. L'pool	13 5 0 to 13 7 6	—
Angles	7 17 6	—
Joists	7 17 6	—
Tees	8 17 6	—
Bridge and Tank Plates	8 12 6	—
Boiler Plates	11 0 0	—

NON-FERROUS METALS.

SWANSEA—	
Tin-plates, I.C., 20 by 14	18/6 to 18/7½
Block Tin (cash)	227 15 0
,, (three months)	227 2 6
Copper (cash)	63 7 6
,, (three months)	63 11 3
Spanish Lead (cash)	20 3 9
,, (three months)	20 13 9
Spelter (cash)	25 17 6
,, (three months)	25 11 3
MANCHESTER—	
Copper, Best Selected Ingots	68 5 0
,, Electrolytic	69 0 0
,, Strong Sheets	94 0 0
,, Tubes (Basis Price), lb.	0 1 1
Brass Tubes (Basis Price), lb.	0 0 11½
,, Condenser, lb.	0 1 2
Lead, English	23 0 0
,, Foreign	21 15 0
Spelter	26 5 0
Aluminium (per ton)	£107

FERRO ALLOYS.

	Per Ton.	Per Unit.
Tungsten Metal Powder	1/7½ per lb.	
Ferro Tungsten	1/3 per lb.	
Ferro Chrome, 4 p.c. to 6 p.c. carbon	£22 2 6	7/6
,, ,, 6 p.c. to 8 p.c. ,,	£22 0 0	7/-
,, ,, 8 p.c. to 10 p.c. ,,	£21 15 0	6/-
,, ,, Specially refined		
,, ,, Max. 2 p.c. carbon	£34 0 0	12/-
,, ,, ,, 1 p.c. carbon	£40 10 0	15/-
,, ,, ,, 0·70 p.c. carbon	£45 0 0	17/-
,, ,, ,, carbon free	1/2 per lb.	
Metallic Chromium	2/5 per lb.	
Ferro Manganese (per ton)	£13 10 0 for home	
	£13 10 0 for export	
,, Silicon, 45 p.c. to 50 p.c.	£13 0 0	scale 5/- per unit
,, ,, 75 p.c.	£20 10 0	scale 6/- per unit
,, Vanadium	14/3 per lb.	
,, Molybdenum	4/6 per lb.	
,, Titanium (carbon free)	1/2 per lb.	
Nickel (per ton)	£170 to £175	
Ferro-Cobalt	9/6 per lb.	

FUELS.

SCOTLAND.

(*Prices not stable.*)

	Export.
LANARKSHIRE—	
(f.o.b. Glasgow)—Steam	13/9
,, ,, Ell	14/6
,, ,, Splint	16/3 to 17/-
,, ,, Trebles	13/3
,, ,, Doubles	12/3
,, ,, Singles	11/3
AYRSHIRE—	
(f.o.b. Ports)—Steam	13/6
,, ,, Jewel	15/6
,, ,, Trebles	12/6
FIFESHIRE—	
(f.o.b. Methil or Burntisland)—Steam	10/9 to 12/9
Screened Navigation	18/-
Trebles	12/3 to 12/9
Doubles	12/3 to 12/6
Singles	11/3
LOTHIANS—	
(f.o.b. Leith)—Best Steam	11/6 to 12/-
Secondary Steam	11/6
Trebles	12/3
Doubles	12/-
Singles	11/3

ENGLAND.

(3) N.W. COAST—	
Steams	24/- to 25/-
Household	37/6 to 50/-
Coke	22/6 to 23/6
NORTHUMBERLAND—	
Best Steams	13/3 to 13/6
Second Steams	11/9 to 12/-
Steam Smalls	9/- to 9/6
Unscreened	11/9 to 12/-
Household	21/- to 27/-
DURHAM—	
Best Gas	15/-
Second	13/3 to 13/9
Household	21/- to 27/-
Foundry Coke	17/6 to 18/-

SHEFFIELD—	Inland.
Best Hand-picked Branch	27/6 to 29/6 —
Derbyshire Best Bright House	20/6 to 21/6 —
Best House Coal	19/- to 20/6 —
Screened House Coal	16/- to 17/6 —
,, ,, Nuts	15/6 to 16/- —
Yorkshire Hards	15/- to 16/- —
Derbyshire Hards	15/- to 16/- —
Rough Slacks	8/6 to 9/6 —
Nutty Slacks	6/- to 7/- —
Smalls	3/- to 4/6 —
Blast-furnace Coke (Inland)	13/- at ovens —
Furnace and Foundry Coke (Export), f.o.b.	17/6 to 18/6

(9) SOUTH WALES.

CARDIFF—	
Steam Coals:	
Best Smokeless Large	19/3 to 20/-
Second Smokeless Large	18/6 to 19/-
Best Dry Large	18/- to 18/9
Ordinary Dry Large	17/3 to 18/-
Best Black Vein Large	17/3 to 17/9
Western Valley Large	16/9 to 17/3
Best Eastern Valley Large	16/6 to 17/3
Ordinary Eastern Valley Large	16/3 to 16/6
Best Steam Smalls	12/6 to 13/-
Ordinary Smalls	11/- to 12/6
Washed Nuts	17/- to 21/-
No. 3 Rhondda Large	19/6 to 20/-
,, ,, Smalls	14/- to 14/9
No. 2 ,, Large	16/- to 16/6
,, ,, Through	14/6 to 15/6
,, ,, Smalls	12/6 to 13/6
Foundry Coke (export)	30/- to 37/6
Furnace Coke (export)	27/6 to 30/-
Patent Fuel	21/6 to 22/6
Pitwood (ex ship)	26/9 to 27/-
SWANSEA—	
Anthracite Coals:	
Best Big Vein Large	32/- to 35/-
Seconds	24/6 to 27/6
Red Vein	20/6 to 27/-
Machine-made Cobbles	40/- to 42/6
Nuts	37/6 to 42/6
Beans	23/6 to 26/9
Peas	17/9 to 19/-
Breaker Duff	8/- to 8/6
Rubbly Culm	10/3 to 10/6
Steam Coals:	
Large	17/6 to 18/6
Seconds	16/- to 17/-
Smalls	10/- to 12/-
Cargo Through	15/- to 16/-

(1) Delivered. (2) Net Makers' works. (3) f.o.t. Makers' works, approximate. (4) Delivered Sheffield. (5) Glasgow, Lanarkshire and Ayrshire.

(6) Home Prices—All delivered Glasgow Station. Boiler Plates 10/- extra delivered England. (7) Export Prices—f.o.b. Glasgow. (8) Except where otherwise indicated, coals are per ton at pit for inland and f.o.b. for export, and coke is per ton on rail at ovens and f.o.b. for export. (9) Per ton f.o.b. (a) Delivered Glasgow. (b) Delivered Sheffield. (c) Delivered Birmingham. (d) Rebate 12/6 joists and 10/- all other materials if home consumers confine purchases solely to British products.

French Engineering Notes.

(From our own Correspondent in Paris.)

Steel Production.

ALL the members of the International Steel Union exceeded their quota of production during the first quarter of the year, and it appears fairly certain that there will be a still larger excess during the second quarter, for the demand has been so heavy of late that iron and steel producers are unable to accept further orders for early delivery. At the next meeting of the Cartel, to be held in Dusseldorf, the French and Belgian steelmakers will ask for an increase of 2,000,000 tons for the third quarter, but it is understood that the request will be resisted by the Germans, who find that there has been some restriction of home demand. It is expected in France that a compromise will be effected. On the French market the situation is steadily improving, and more activity is observable in nearly all branches of the engineering industries.

Continuous Brakes.

A first order for continuous brakes, to the value of 50 million marks, is being placed in Germany on account of reparations, and orders for a similar amount are being distributed in France. The Germans will supply Westinghouse brakes, which are alone accepted by the French Government. It is not intended to fit the whole of the 524,000 trucks and vans with brakes, as the companies consider that sufficient braking effect is obtained when 54 per cent. of the wagons are so equipped. One-half of the 289,000 vehicles will have brakes sufficiently powerful for the full load, and the other half for the tare only. This will obviously complicate the making up of trains, but the work of transformation will have to be carried out as economically as possible. As it is, the total cost is estimated to be 1600 million francs, and the work of equipping the goods trains will occupy about six years. Meanwhile, the International Railway Union has definitely accepted the Drolshammer brake, mainly by the support given to it by the Swiss Federal Railways, which have subjected it to exhaustive tests, so that the three brakes now recognised are the Westinghouse, Kunze-Knorr, and Drolshammer. It is affirmed that the patents for the last-named invention have been acquired by one of the groups interested in other brakes, so that it is by no means certain that much more will be heard of it in the future.

Economic Organisation.

A feature of the situation is the care and thoroughness with which the Government and the various national bodies are carrying out the work of economic re-organisation. It is felt that in view of the threatened over-production and increasing costs, something must be done to avoid what is likely to be a crisis in the comparatively near future. The consumption is not keeping pace with the increasing output. The fuel problem is the first to be dealt with. Manufacturers all over the country were recently required to make a statement of the kind of motive power they used and the consumption of fuel or electric current. At the last meeting of the Conseil National Economique, it was decided to carry out an extensive inquiry into the industrial situation generally and to determine upon the means by which it can be improved. The programme covers the means of increasing production, improving the quality of the goods and reducing costs. At the same time, it will take into account an improvement in the condition of workers and a better understanding between employers and men.

Transport Charges.

The first International Congress of Masonry and Reinforced Concrete, which has been held in Paris, dealt with every possible aspect of concrete construction, and it appeared from the papers and discussions that, while concrete possesses the advantage of being easily moulded to any form, it has superseded stone largely on account of the cost of transport. As a building material it is not appreciably cheaper. Even the cost of concrete is burdened unduly with transport charges, and at the final meeting of the Congress resolutions were passed in favour of appealing to the various Governments to do all they could to reduce such charges, which were mainly responsible for the housing problem. It was hoped that the railway companies would send delegates to future Congresses. Meanwhile, it was decided to investigate the running costs of motor lorries for the transport of building materials, and to see what economies could be effected in the way of mechanically loading and unloading railway trucks and canal barges, while other economies are sought in the use of electric lorries in centres where there are facilities for re-charging secondary batteries.

Railways and Aviation.

The railway companies have come to the conclusion that the only way to avoid a dangerous competition is to interest themselves directly in all forms of transport. They neglected the inland waterways, which continue to be actively developed and are proving formidable competitors for the conveyance of bulky material. Now they are threatened with even greater competition from road motor vehicles, and with the lessons of the inland waterways in their minds, the companies are examining various proposals for securing a close co-operation between the two means of transport for their common benefit. The idea is to co-ordinate all the different services, so that while developing transport, they will bring traffic to each other. The companies are even taking a lead in the creation of new air services, and were responsible for the formation of a committee which is carrying out preliminary arrangements for establishing an air line between Geneva, Lyons and Bordeaux. At the invitation of the Chamber of Commerce of Lyons a number of representatives of the Swiss and French Governments, railway companies, commercial bodies and others visited that town in order to discuss details, and it was stated that next year the air station to be constructed at the Bron aerodrome, at Lyons, for the Geneva–Lyons–Bordeaux service will be one of the largest and best equipped in Europe. The railway companies were complimented on their enterprise in financially assisting the new air service.

British Patent Specifications.

When an invention is communicated from abroad the name and address of the communicator are printed in italics.

When an abridgment is not illustrated the Specification is without drawings.

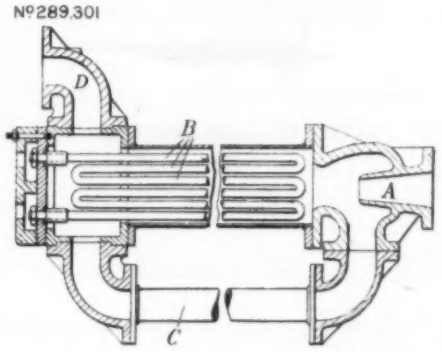
Copies of Specifications may be obtained at the Patent Office Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.

The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.

CONDENSERS AND FEED-WATER HEATERS.

289,301. July 29th, 1927.—BOILER FEED-WATER HEATERS, J. N. Wyndham and S. L. Wyndham, Seager's Buildings, Bute-street, Cardiff.

The peculiarity in this feed heater lies in the arrangement made to provide a circulation of the water. The feed is introduced

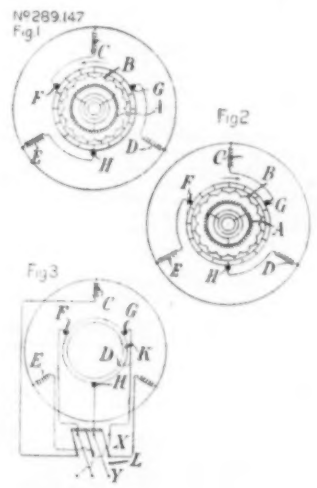


at A and is heated by means of steam in the coil B. The inlet, it will be seen, is in the form of a nozzle, and the jet thus formed induces a circulation through the return pipe C. It is claimed that only the hottest water will be sent away by the delivery D, while the colder water will be re-circulated, and that the heater is as effective as one of the multi-flow type.—*April 26th*, 1928.

DYNAMOS AND MOTORS.

289,147. January 20th, 1927.—IMPROVEMENTS IN AND RELATING TO DYNAMO-ELECTRIC MACHINES, The British Thomson-Houston Company, Ltd., of Crown House, Aldwych, London, W.C. 2, and Herbert Dreghorn, of 14, Bath-street, Rugby.

This specification describes a compensated induction motor, in which the current characteristic for both directions of running is obtained without altering the positions of the brushes by means of a switch interposed between the secondary winding and the commutator brushes. Fig. 1 shows a two-pole motor having a three-phase secondary winding connected for counter-clockwise rotation of the motor; Fig. 2 shows the secondary winding connected for clockwise rotation; and Fig. 3 shows the switch interposed between the secondary winding and the brushes. A represents the primary winding of the motor, B

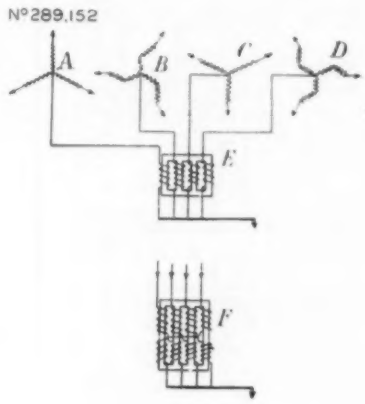


the regulating winding, and C, D and E the phases of a three-phase secondary winding. The ends of the secondary winding are connected to brushes F, G and H on the commutator K. The windings are so proportioned that the necessary power factor improvement is produced when the brushes are displaced 60 deg. The brushes F and G are then equidistant from the axis of the winding C. A switch L is interposed—as shown in Fig. 3—between the secondary winding and the brushes When the switch is in position X—Fig. 3—the connection shown in Fig. 1 is obtained, which gives the right shift for counter-clockwise rotation. Movement of the switch to position Y effects the connection shown in Fig. 2, which gives the right shift for clockwise rotation. In each case there is a shift of 60 deg. The switch may conveniently be combined with the switch that reverses the primary leads.—*April 20th*, 1928.

TRANSFORMERS AND CONVERTERS.

289,152. January 21st, 1927.—IMPROVEMENTS IN AND RELATING TO ELECTRIC ARC RECTIFIERS, The British Thomson-Houston Company, Ltd., of Crown House, Aldwych, London, W.C. 2, and John Carley Read, The Square, Crewkerne, Somerset.

In the drawing a twelve-phase transformer secondary winding has been taken as an example. The twelve-phase star-connected secondary winding has been split up into four three-phase star-connected systems, A, B, C and D, each symmetrical so far as itself is concerned, and each displaced by 30 electrical degrees from any of the others. The drawing shows two of the three-phase systems, B and D, zigzag connected, but this is not essential, and any of the other well-known methods of obtaining a twelve-phase star with a uniform phase displacement of 30 deg. between adjacent phases could equally well have been used. The lead from the end of each phase of the twelve-phase winding is connected to an anode of the rectifier. The leads from the four neutral points are brought each to one leg of a four-legged interphase transformer E, the windings on all the four legs of the transformer E being in the same direction and joined together at a common star point after passing through the transformer. This common star point forms the negative pole of the direct-current system. The interphase transformer E has the disadvantage that the direct-current components in the currents from the four star points all magnetise the four legs

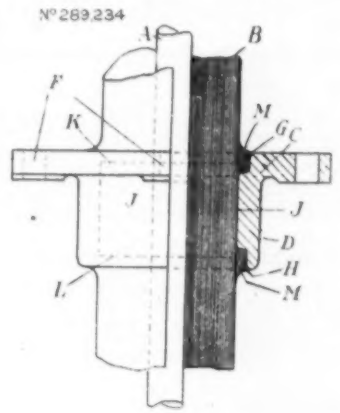


of the transformer in the same direction, and the direct-current leakage flux through the air from yoke to yoke of the transformer may easily saturate the legs to such an extent as to render the working unsatisfactory. This difficulty may be overcome by winding on each leg of the interphase transformer two windings which are closely inductively related together, wound in opposite directions, and connected respectively in series with star points of systems 30 deg. apart. This constitutes a zigzag connection of the interphase transformer windings, and is illustrated at F. The scheme is cheaper than a simple star connected secondary winding for twelve or more phases, and certain other advantages are given. The function of the interphase transformer is to enable each of the star-connected groups, such as A, to operate like a three-phase rectifier.—*April 28th*, 1928.

ELECTRICAL APPLIANCES.

289,234. March 23rd, 1927.—IMPROVEMENTS IN OR RELATING TO THE INSULATION OF HIGH-TENSION ELECTRICAL APPARATUS, The General Electric Company, Ltd., of Magnet House, Kingsway, London, W.C. 2, and Charles Cornfield Garrard, of the General Electric Company, Ltd., Engineering Works, Witton, Birmingham.

This invention relates to the insulation of high-tension electrical apparatus, such as static transformers and switchgear. In order to make more uniform and gradual the drop of potential from parts of high tension to surrounding bodies at lower potentials electrically conductive shields have been arranged between those parts and the said bodies. It has been found, however, that a corona discharge is liable to occur at the edges of such shields. In the drawing the round copper bar A is covered by a tube B of paper material impregnated with a phenol formaldehyde condensation product, and shrunk on



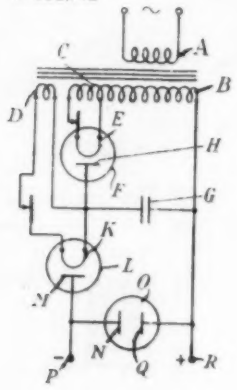
to the outside of tube B is a metal clamp C for maintaining the primary winding of a current transformer in position. The clamp C comprises a main tubular part D from one end of which projects an annular flange provided with holes F for clamping bolts. The ends of the tubular part D are formed with internal annular recesses G and H. Between the tube B of insulating material and metal clamp C is a layer J of tinfoil, the ends K and L of which are contained in the channels formed by the outer wall of the tube B and the faces of recesses G and H respectively. The channels are filled with a suitable insulating composition M. For example, the channels may be filled with a paste composed of mica dust and shellac, the paste being subsequently hardened by baking. Thus the ends K and L of the tinfoil are covered by insulating material having a dielectric strength greater than air or than that of the material of the tube B. Another example of the invention is illustrated and described.—*April 26th*, 1928.

282,742. December 12th, 1927.—IMPROVEMENTS IN OR RELATING TO CIRCUIT ARRANGEMENTS FOR SMOOTHING A PULSATORY OR OTHER NON-UNIFORM "DIRECT" CURRENT, N. V. Philips' Gloeilampenfabrieken, Emmasingel 6, Eindhoven, Holland.

The invention is concerned with a circuit arrangement which permits the smoothing of a pulsatory or other non-uniform "direct" current, such as is obtained, for example, by rectifying an alternating current or from a network fed by a commutator direct-current machine. A source of alternating current, for example, a lighting network, supplies the primary winding A of a transformer. This transformer has three secondary windings B, C and D, of which the winding B serves to supply the alternating current which has to be rectified and

smoothed, the winding C being designed to feed a cathode E of a diode F which also comprises an anode H and which serves to rectify the alternating current. A condenser G of large capacity, which acts as a buffer, is connected between the right-hand end of the winding B and the anode H, the latter being further connected to a filament K of a second diode L, which is so chosen as to be saturated under normal operating conditions, so that variations of its terminal voltage within rather wide limits do not exert any perceptible influence on the current which passes through the diode. The anode M is connected to the cathode N of a discharge tube O, which operates with an independent discharge, for example, in a rare gas such as argon or neon. The cathode M of the tube O is connected to a negative terminal P, the anode Q of the tube being connected to a positive terminal R of the apparatus and to the right-hand end of the

N°282,742



transformer winding B. Finally, the secondary transformer winding D serves to feed the cathode K of the diode F. The discharge tube O possesses the property that during variations within certain limits of the current intensity of the discharge the terminal voltage of the tube remains constant. It is consequently evident that variations in the current intensity within the diode L, although causing similar variations in the current intensity within the discharge tube O, are not perceptible in the apparatus connected between the terminals P and R as the tension between the terminals P and R remains perfectly constant. The circuit arrangement shown relates to the smoothing of a rectified alternating current. It will be evident, however, that without any fundamental alteration this circuit arrangement is equally suitable for smoothing the "rippled" direct current supplied by a commutator machine.—*April 26th*, 1928.

FURNACES.

289,344. October 15th, 1927.—FURNACES FOR LANCASHIRE BOILERS, N. D. F. Johnson, Royston Works, Upper Richmond road, Putney, London, S.W.

In this furnace there is, beyond the normal grate A and bridge B, a secondary grate C, comprising a number of perforated blocks of refractory material. Behind this secondary grate there

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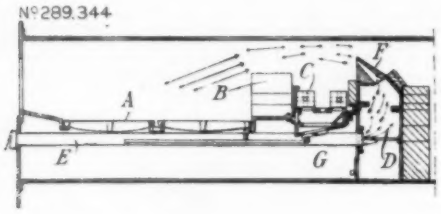

is an air heating chamber D, to which air is supplied by the pipe E. The outlet from this chamber is by means of the nozzles F, which are directed towards the front of the furnace. It is suggested that any unburned fuel will be consumed over, or on, the secondary grate, and that any grit passing over the bridge will be deposited thereon. A slide G is provided for the discharge of this material into the ashpit.—*April 26th*, 1928.

CRANES AND CONVEYORS.

288,935. December 3rd, 1927.—SHAKER CONVEYORS, T. G. Nyborg and H. C. Jenkins, Meco Works, Worcester.

The aim in designing this conveyor, which is intended for underground work, where it may frequently have to be moved, has been to provide unusual flexibility. The conveyor is driven

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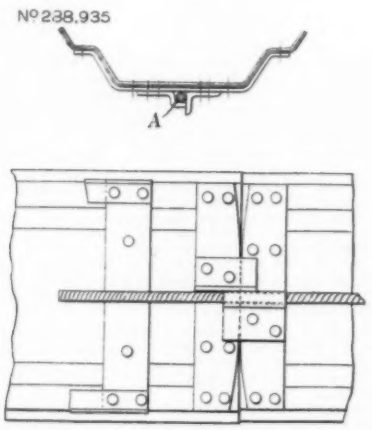

by any standard form of reciprocating engine, the connecting-rod of which is made fast to a rope running the length of the conveyor and fixed at the opposite end. The result is that on the return stroke the driving force is transmitted to the far end by the rope, and the various sections of the conveyor are always driven by a pushing action which, the inventors claim, tends towards flexibility. The rope is shown at A, held between two simple clips.—*April 19th*, 1928.

MISCELLANEOUS.

289,290. July 11th, 1927.—DEVICES FOR THE PROTECTION OF SCREW THREADS, *E. A. Garratt*, 78, *Gracechurch-street, London, E.C.* 3.

This device is intended for the protection of screw threads on the ends of pipes during transit. It comprises a sleeve A, which is formed as shown in the illustrations, according as to whether it is for an external or an internal thread. Near the

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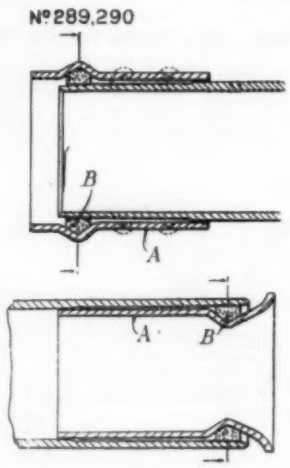

outer end of the protector there is a bulge B, which is filled with soft metal. This metal is threaded on to the pipe end. It is, it is said, important that the protector should project beyond the end of the pipe, so that should a pipe accidentally experience a shock so severe as to distort the protector this distortion may take place at a point where the protector is not in actual contact with the pipe.—*April 26th*, 1928.

289,308. August 10th, 1927.—REMOVING GRAPHITE INCRUSTATIONS FROM COKE OVENS, G. Capiau, 14, Rue Anatole France, La Louvière, Belgium, M. Gauquier, 156, Rue de la Flache, La Louvière, and L. Lahaut, 15, Rue Mitant des Camps, La Louvière.

This invention relates to a process of removing incrustations of graphite such as are formed in the carbonising chambers of coke ovens. These graphite formations are extremely hard. They form, chiefly at the top of the chambers, compact crusts, the thickness of which gradually increases, so that they may bring about a substantial reduction in the capacity of the chambers and clogging of the gas outlets. It therefore is necessary periodically to remove these incrustations. This is usually done by hand, and requires the oven to be put out of operation for a not inconsiderable time. The process, according to the invention, makes it possible to remove the graphite crusts without its being necessary to allow the oven to cool down, thus saving considerable time and avoiding the production of cracks in the brickwork and other inconveniences attendant on the cooling of the walls. The improved process consists in projecting on to the graphite a hard material in powdered or granular form by means of air pressure, so as to cut the graphite into blocks, which subsequently can be loosened or knocked off without difficulty. The powdered or granular material used must, it is stated, be very hard and of substantial specific weight, for example, granulated plumbago or crushed slag, which have given very good results when projected by a current of air at a pressure of at least 7 atmospheres. The illustration shows how the cuts may be made down the centre and sides of the oven roof.—*April 26th*, 1928.

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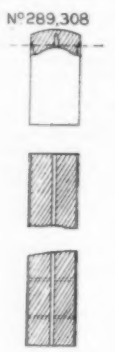

289,302. July 30th, 1927.—DECORTICATING MACHINERY, H. Boby, Ltd., St. Andrews Ironworks, Bury St. Edmunds, and M. Soenens.

Two objects are aimed at in this invention. One is the more thorough scutching of the fibre being treated and the other is the

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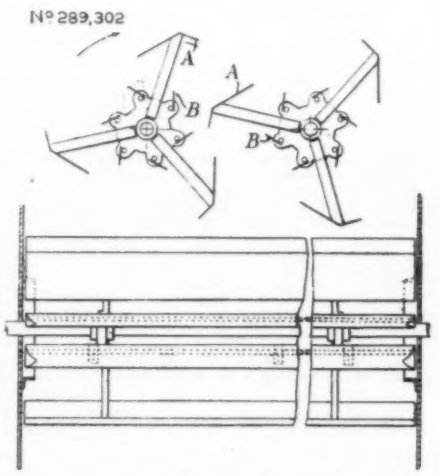
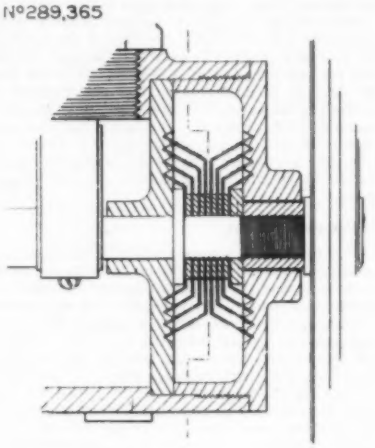


reduction of trouble through the bearings becoming clogged with dust and tow. To these ends there are arranged within the beaters A A a series of deflector plates B B, which throw off a current of air that drives the fibre against the opposite set of beaters. The flow of air goes inward through the side frames in the vicinity of the bearings, so that *débris* is carried forward and does not clog up the bearings.—*April 26th*, 1928.

289,365. January 12th, 1928.—LABYRINTH PACKINGS, H. A. Fraser, 13, Wharf-road, London, N. 1, W. L. Price, 28, Moss Hall-grove, Woodside Park, London, N. 12, and J. Hetherington, 1, Belgrave-terrace, Stockwell Park, London, S.W. 9.

This labyrinth packing is put forward as being specially suitable for use in connection with the crank shafts of refrigerator compressors. There are connected with the shaft to be packed two series of concentric cup-shaped sheet metal members, the rims of the two series extending in opposite directions and making

N°289,365



joints respectively with the opposite walls of the packing or gland chamber by engaging grooves therein. The spaces within and between the cup-shaped members of both series are filled with a lubricant, preferably a mixture of grease, graphite and mercury, the heavier particles of the mixture being thrown by centrifugal action to the edges of the members and providing a metallic seal with the groove sides without undue friction. It is pointed out that should any leakage pass the first group of discs it will have a tendency to press the second set into more intimate contact with the grooves.—*April 26th*, 1928.

Forthcoming Engagements.

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion the necessary information should reach this office on, or before, the morning of the Wednesday of the week preceding the meetings. In all cases the TIME *and* PLACE *at which the meeting is to be held should be clearly stated.*

TO-DAY.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.—Council House, Birmingham. West Midland district meeting. 5.30 p.m.

ROYAL INSTITUTION OF GREAT BRITAIN.—21, Albemarle-street, W.1. Discourse, "The Results of the Further Excavations at Ur," by Mr. C. Leonard Woolley. 9 p.m.

TO-DAY AND SATURDAY, JUNE 2ND.

THE INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.—The Hydro, Peebles. Scottish District meeting.

SATURDAY, JUNE 2ND.

INSTITUTION OF CIVIL ENGINEERS: YORKSHIRE ASSOCIATION. Visit to Bradford Waterworks, Scar House reservoir. 2 p.m.

SUNDAY TO THURSDAY, JUNE 3RD TO 7TH.

INSTITUTION OF CIVIL ENGINEERS.—Gt. George-street, S.W.1. Celebration of the Centenary of Incorporation by Royal Charter; Engineering Conference. For programme see pages 357 and 543.

MONDAY, JUNE 4TH.

THE SURVEYORS' INSTITUTION.—12, Great George Street, S.W.1. Annual General Meeting. 5 p.m.

SATURDAY, JUNE 9TH.

THE SOCIETY OF ENGINEERS.—17, Victoria-street, S.W.1. Visit to the London Terminal Aerodrome at Croydon. 3 p.m.

WEDNESDAY, JUNE 20TH.

INSTITUTION OF CIVIL ENGINEERS: YORKSHIRE ASSOCIATION.—Visit to G. and T. Earle's Humber cement works.

CONTRACTS.

BLACKSTONE AND CO., Ltd., of Stamford, have received from the Auckland City Council an order for one Blackstone two-cylinder 76 B.H.P. "spring injection" heavy fuel oil engine.

THE GENERAL ELECTRIC COMPANY, Ltd., has entered into a contract with the Government of India for two years' supply of electric direct-current and alternating-current ceiling fans. The total number required, it is anticipated, will run into many thousands.

CAMMELL LAIRD AND CO., Ltd., of Birkenhead, have received an order from Messrs. James Chambers and Co., Liverpool, on behalf of the Lancashire Shipping Company, for two cargo liners, each of about 10,000 tons deadweight, which are to be fitted with Diesel engines.

THE GREAT WESTERN RAILWAY announces officially that the following contracts have been placed:—(*a*) Erection of the station buildings on the down side at Newport (High-street) Station, Messrs. E. Turner and Sons, Penarth-road, Cardiff; (*b*) erection of a new warehouse and garage for the Associated Biscuit Manufacturers at Pengam, Cardiff, Messrs. E. Turner and Sons, Penarth-road, Cardiff; (*c*) provision of two 30-cwt. electric lifts at South Lambeth goods station, the Titan Lift Company, 21, Pancras-road, London, N.W. 1; (*d*) supply of a duplex boring mill for No. 15 shop, carriage and wagon works, Swindon, Webster and Bennett, Ltd., Northey-road Works, Foleshill, Coventry; (*e*) renewal of upper gates at Cardiff, East Dock inner lock, the Fairfield Shipbuilding and Engineering Company, Ltd., Chepstow, Mon.; and (*f*) provision of reinforced concrete floor in shed, &c., Messrs. Davies, Middleton and Davies, 17, St. Andrews-crescent, Cardiff.